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## Factors that affect adverse outcomes of pregnancy among women with ages 15 to 49 in Pretoria, South Africa

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# **Factors that affect adverse outcomes of pregnancy among women with ages 15 to 49 in Pretoria, South Africa**

**Zelege Bekele Worku**

**SPIRIT PhD Series**

**Thesis no. 35**

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**Factors that affect adverse outcomes of pregnancy among women with ages 15 to 49 in Pretoria, South Africa**

**By**

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**A DISSERTATION SUBMITTED TO THE FACULTY OF SOCIAL SCIENCES OF AALBORG UNIVERSITY IN DENMARK IN  
FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF Dphil  
IN SOCIAL SCIENCES**

**September 2011**

## DECLARATION

I, Zeleke Bekele Worku, declare that this dissertation is my own original research work, and that it is based on the analysis of data sets I collected from the City of Tshwane Metropolitan Municipality (CTMM) between 2004 and 2009. My dissertation is being submitted to the Faculty of Social Sciences of Aalborg University in Denmark for the degree of Doctor of Philosophy (Dphil) in social sciences. I confirm that this research work has not been submitted to any other university for the purpose of examination or degree.

Name of student: Zeleke Bekele Worku

Signature of student:.....

Date: \_\_\_\_\_

Place: Aalborg, Denmark

This research report has been submitted for examination with our full approval.

Name of first promoter: Professor Mammo Muchie

Signature .....

Date: \_\_\_\_\_

Place: Aalborg, Denmark

Name of second promoter: Professor Henrik Halkier

Signature .....

Date: \_\_\_\_\_

Place: Aalborg, Denmark

## **DEDICATION**

I dedicate this work to my daughter, Edna Worku, who was born on 02 March 2000.

## ACKNOWLEDGEMENTS

My profound thanks go to the following parties for the generous support they provided during the study:

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- Dr. Delphin Tshibangu of University of Pretoria for serving as a public health and medical advisor during the entire period of study.
- Dr. T. J. D. Van Staden and Ms. Joan De Beer of City of Tshwane Metropolitan Municipality (CTMM) for granting permission for using data sets gathered between 2004 and 2009 for conducting this study.
- Mr. Solomon Khale of City of Tshwane Metropolitan Municipality (CTMM) for supervizing the data collection procedure.
- The City Planning Division of the CTMM for providing GIS maps that were required for the study.
- Ms. Brigid Boltman and Ms. Chris Fourie of LEAP Specialist Strategic & Planning Solutions for training and supervising data collectors during the entire period of study.
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- The enumerators who collected data from respondents during the period of study.

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## ABSTRACT

### **Factors that affect adverse outcomes of pregnancy among women with ages 15 to 49 in Pretoria, South Africa**

**Background:** Poor and uneducated women living in and around the City of Pretoria are characterized by adverse outcomes of pregnancy, high teenage pregnancy, and poor utilization of contraceptives and modern family planning methods. A 6-year long survey (2004 to 2009) was conducted annually by the City of Tshwane Metropolitan Council (CTMM) in Pretoria, South Africa in order to identify factors responsible for adverse pregnancy outcomes and underutilization of modern contraceptives and family planning services provided by the CTMM. Data were gathered from a random sample of 8, 497 women aged between 15 and 49 years on socio-economic, demographic, health-related and family planning variables. Observed values of variables were recorded at the end of the study period (31 December 2009). For survival analysis, data gathered between 01 January 2004 and 31 December 2009 were used.

**Objectives:** The objectives of study were to identify key predictors of adverse outcomes of pregnancy among women aged between 15 and 49 years living in and around the City of Pretoria, and to assess the degree of utilization of modern family planning methods.

**Research questions:** What are the key factors that are responsible for adverse outcomes in pregnancy among women aged between 15 and 49 years living in and around the City of Pretoria? What is the degree of utilization of modern contraceptives? What are the key factors that affect utilization of family planning services provided by the CTMM to women aged between 15 and 49 years living in and around the City of Pretoria? Does utilization of contraceptives and modern family planning methods vary by service delivery wards and facilities?

**Methods:** Data were collected on several socio-economic, demographic, health-related and family planning variables from a random sample of 8, 497 women between the ages of 15 and 49 living in and around the City of Pretoria using multi-stage cluster sampling over a 6-year period of study. Survey logistic regression analysis was used for identifying factors that significantly influenced utilization of modern family planning methods. The Cox Proportional Hazards Model was used for identifying factors that strongly influenced adverse outcomes of pregnancy. Multilevel analysis was used to test the presence of significant differences among 20 service delivery wards and 11 health facilities with regards to utilization of modern family planning methods by women. Statistical data analysis was performed in the statistical package STATA version 11 (STATA Corporation, 2010).

**Results:** The percentage of women who regularly used modern family planning methods such as condoms, pills, injections, intra-uterine devices and sterilization was 41.74%. The average ages of women at first sex and pregnancy were 18.72 and

19.36 years respectively. Adverse outcomes of pregnancy occurred in 12.19% of women. Injections (54.03%) were most commonly used as a means of modern contraception by the 3, 547 women who used modern contraceptives, followed by pills (19.60%), condoms (15.51%), intra-uterine devices (8.20%), sterilization (2.37%), and vaginal foams (0.28%). Based on odds ratios (OR) estimated from logistic regression analysis with the random effects model, utilization of modern family planning methods such as contraceptives was significantly influenced by easy access to services (OR=4.59; 95% CI = 2.18 – 7.38), degree of support from sexual partners (OR=4.51; 95% CI = 2.14 – 7.16), and degree of satisfaction with the quality of services provided at service centers (OR=4.45; 95% CI = 2.12 – 7.03). Based on hazard ratios (HR) estimated from the Cox Proportional Hazards Model, the occurrence of adverse outcomes of pregnancy was significantly influenced by easy access to family planning services (HR=4.02; 95% CI = 2.13 – 6.59), unwanted pregnancy (HR=3.79; 95% CI = 1.24 – 5.69), and young age at first pregnancy (HR=2.89; 95% CI = 1.19 – 4.22). Adjustment was done for religion, level of income, level of education and employment status. Based on results obtained from multilevel analysis, differences among the 20 service delivery wards accounted for 12.49% of the total variation in the quality of services delivered by the CTMM. The difference among the 11 health service facilities accounts for 13.52% of total variation. Facilities and wards jointly account for 26.01% of the total variation. Facilities nested within the same wards are quite different from each other. Women receiving family planning services within the same health facilities are quite similar with each other (Intra Class Coefficient = 89.37%). This finding clearly shows that services at the level of facilities were not standardized adequately. That is, some facilities were doing much better than others although all facilities are supposed to be equally efficient in terms of service delivery. For example, health facilities rendering family planning services in predominantly white suburbs were significantly better equipped and well resourced in comparison with facilities rendering services in predominantly black suburbs such as Mamelodi.

**Conclusions:** There were significant differences among service delivery centers and health districts with regards to adverse outcomes of pregnancy and utilization of modern family planning services provided by the CTMM. The study showed that unwanted pregnancy and adverse pregnancy outcomes among poor black women constitute a major health problem in and around the City of Pretoria, South Africa. There is a dire need for the promotion of community based family planning services specifically aimed at poor women with ages 15 to 49 years. While it is true that community based clinics are the most efficient health service centers for promoting the use of modern contraceptives and family planning methods, the facilities are underutilized in comparison with hospitals and private sector service providers.

**Key words:** Family planning methods, adverse outcomes, hazard ratio, multilevel analysis.

## **CHAPTER 1: INTRODUCTION AND BACKGROUND OF STUDY**

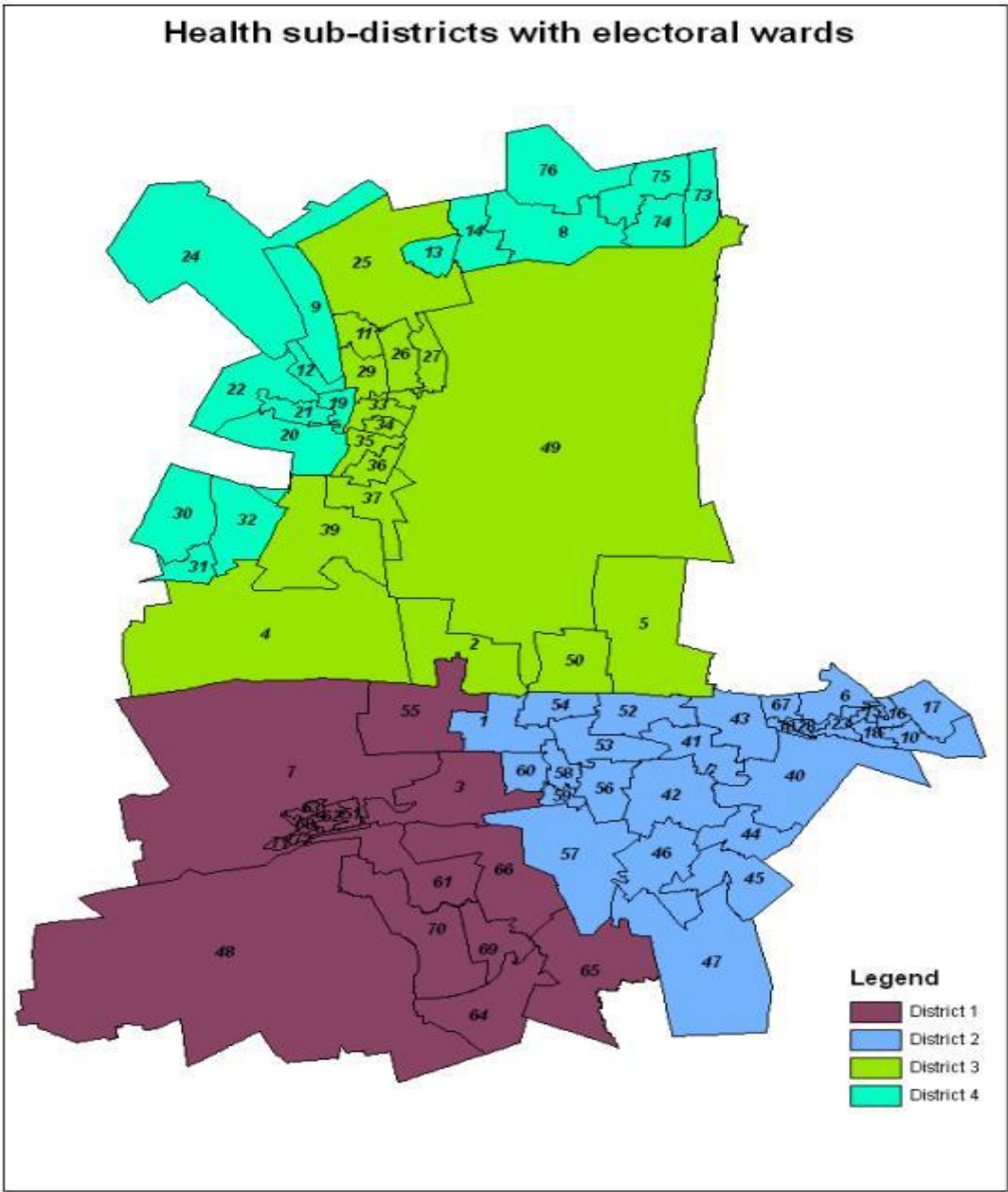
### **1.1 Introduction of study**

The City of Tshwane Metropolitan Municipality (CTMM) is a new geographic municipal entity established in December 2000, has a land area of about 2,198 square kilometers and an estimated population of about 3 million inhabitants of which women represent 50% (Statistics South Africa, 2010). According to the CTMM (2010), women of reproductive age (15-49 years of age) represent 57% of the population of CTMM. The municipal health service is comprised of four health sub-districts (Figure 1) and serves a population made up of different races (Black, Coloured, Indian and White), cultures, life styles and qualities of life.

According to estimates obtained by Statistics South Africa (2009), disease patterns seem to mimic the residential (population groups) and socioeconomic divide with tuberculosis, HIV/AIDS, malnutrition and upper and lower respiratory tract infections affecting the poor and jobless while coronary heart diseases affect mainly the affluent members of the CTMM.

The CTMM has been restructured into four health sub-districts with a view to improve overall efficiency in the quality of municipal health services that are provided to the general population. The newly restructured municipal health services are intended to improve efficiency in service delivery by eliminating the duplication and fragmentation of services, and by optimizing the utilization of essential resources such as logistics, skilled manpower, infrastructure and health facilities. The restructuring process is consistent with Act Number 8 of the Gauteng District Health Services Act of 2000 (Gauteng Department of Health, 2000) in which it is stipulated that the provision of all primary and basic health care services to the general population of the CTMM is the sole responsibility of the municipality.

Figure 1.1: The four health sub-districts of CTMM



According to Kovacs and Raida (2009), adverse outcomes of pregnancy are miscarriage, induced termination of pregnancy or abortions, low birth weight and preterm birth. Poor, unemployed and illiterate black teenagers living in the CTMM commonly experience adverse outcomes of pregnancy. The most common causes of adverse outcomes of pregnancy among black teenagers are lack of sex education, the absence of reproductive health services to vulnerable members of the community, poor access to primary health care and family planning services, poverty and unemployment, illiteracy, as well as the lack of counselling services by suitably trained social workers. Miscarriages and abortions often cause the loss of fetus and permanent injury on women.

The use of modern family planning methods has numerous benefits that many people residing in the City of Tshwane Metropolitan Municipality (CTMM) may not be aware of. Modern contraceptives enable families to determine their optimal family size. Doing so enables parents to be responsible for an optimal number of children in terms of education and health. In addition to preventing unwanted pregnancy, modern contraceptives help in reducing the risk of ovarian as well as endometrial cancer. They are known to be helpful in improving conditions like pelvic inflammatory disease (PID), premenstrual syndrome, and acne among others. They are also helpful in preventing the onset of osteoporosis. Modern contraceptives are quite helpful in decreasing menstrual cramps, ovarian cysts, ectopic pregnancy, and rheumatoid arthritis. They also bring about much needed relief to women who have irregular periods, by getting their menstrual cycle to a regular routine. Most contraceptives lead to less bleeding during periods. Some of the birth control contraceptives are said to have beneficial effects on cholesterol. They are also helpful in reducing breast diseases and breast cysts. A woman using these birth control measures may not have to worry about excessive hair, as some contraceptives help to get rid of excess body hair. Although modern family planning methods have numerous benefits to men and women, they are expensive, and are not so easily available to poor women and men residing in the CTMM. Poor and illiterate women residing in the CTMM often struggle to pay for modern contraceptives although the contraceptives can help them by avoiding unplanned pregnancies as well as health-related problems (Moskowitz and Jennings, 2005).

According to Statistics South Africa (2010), the total number of people residing in the CTMM is roughly equal to 3 million. Women account for 50% of population. Fifty seven percent of women are aged 15 to 49 years. More than 50% of black females are characterized by low income, high unemployment rate, unwanted pregnancies, miscarriages, abortions and poor access to family planning services. There are 4 major health districts in CTMM and 20 electoral wards in the CTMM. Black females account for 64.7% to 68.7% of the female population. White



females account for 28.1% to 30.1% of the female population. Indian and Coloured females account for 3.2% to 5.2% of the female population. Disease patterns follow socio-economic status in which the rich experience cardio-vascular diseases such as high cholesterol and myocardial infection, whereas the poor suffer from infectious diseases that are common to Sub-Saharan African countries. The poor are characterized by unemployment, abject poverty, and suffer from tuberculosis, HIV/AIDS, malnutrition, and upper and lower respiratory tract infections.

Table 1.1, below, shows 11 categories of service providers that render family planning services to the general population residing in and around Pretoria:

**Table 1.1: Family planning service providers in and around Pretoria**

<b>Facility providing family planning services</b>	<b>Percentage of people utilizing service</b>
Public clinics	20.22%
Public hospitals	14.04%
Private surgeries	12.92%
Private pharmacies	11.24%
Private hospitals	8.99%
Educational institutions	7.87%
Public health service centers	6.74%
Non-governmental organizations	6.18%
Private clinics	5.06%
Midwives	3.93%
Faith-based health service centers	2.81%
<b>Total</b>	<b>100% (N=8, 497)</b>

This study is based on data collected from a random sample of 8, 497 women aged 15 to 49 years living in and around the City of Pretoria between 2004 and 2009 as part of a 6-year long follow-up study conducted by the City of Tshwane Metropolitan Municipality (CTMM). Data were collected from the 8, 497 women who took part

in the study on several socio-economic, demographic, health-related and family planning variables. The purpose of study was to assess the degree of utilization of modern family planning methods provided by the CTMM to the general population at the various health facilities located in and around the City of Pretoria. The City of Pretoria is part of the City of Tshwane Metropolitan Municipality (CTMM). Pretoria is located in Gauteng Province, and is the Capital City of South Africa. The CTMM is responsible for providing primary health care services to the general population in accordance with Act Number 8 of 2000 of the Gauteng District Health Services Act although the degree and quality of services provided since 2000 has been less than satisfactory (Gauteng Department of Health, 2000). The CTMM intends to use findings from this study for formulating a reproductive health policy that is relevant to the needs of the general population. The CTMM also intends to use findings from the study to identify factors that affect the choice of modern contraceptive methods by women aged between 15 and 49 years. The study is expected to produce vital statistics such as the prevalence rate of contraceptive use, the choice of contraceptive methods, and the effect of the reproductive health services provided by the CTMM on the general population residing in the CTMM.

Prior to April 1994, historically disadvantaged women living in the CTMM have had limited access to reproductive health services provided by various health facilities in the CTMM. Such women were mostly black, illiterate and poor, and their families have had limited access to valuable reproductive health services and information that are crucial for sound family planning and the effective utilization of modern contraceptives. Family sizes among such women were not commensurate with economic means. Such women were prone to adverse pregnancy outcomes and relatively higher under-five morbidity and mortality rates (Kleinschmidt, Maggwa, Beksinska and Rees, 2003). The key objective of the study was to highlight the basic reproductive characteristics and needs of all population groups residing in the CTMM. The study was based on a representative random sample of size 8, 497 women who lived in the four health districts of the CTMM. Multi-stage cluster sampling with probability proportional to size (PPS) was used for the selection of eligible women. A suitable sampling frame was obtained from Statistics South Africa, and was used along with a questionnaire that was used for conducting the 1998 South African Demographic Health Survey (SADHS 1998). As such, the list of variables of study used for data collection in this study were quite similar to those used by the South African Department of Health for conducting surveys on reproductive health as well as maternal and child morbidity and mortality. The CTMM consists of four health sub-districts. The selection of these variables is based on the conceptual framework that recognizes that the choice of contraceptives depends on the extent to which services are utilized by the general population, as well as individual, program level and community level factors

(Johns Hopkins School of Public Health, 2004; Bertrand, Magnani & Rutenberg, 1996). In this study, contraceptive use is expected to vary depending on the type of service provided, the quality of service provided, health district or clinic. Multilevel analysis was used in order to assess the degree of variability at the levels of health districts and clinics. Binary and multinomial logistic regression models were used for identifying key predictors of contraceptive use. Adjusted odds ratios were used as a measure of effect. Factors that affect the duration of utilization of one or more modern family planning methods are identified based on the Cox Proportional Hazards Model in which hazard ratios are used as an epidemiological measure of effect.

The study aims to assess the extent to which modern family planning services are made available to ordinary men and women who need the services, utilization of modern contraceptives at the various health districts and service delivery centers, the degree of sexual activity by those who utilize modern family planning services, the use of traditional methods of contraception by men and women, and the presence of easy access to service delivery centers operated by the CTMM. Respondents are said to utilize modern family planning methods if they use one of more contraceptive methods such as pills, injection, condoms, sterilization and intra-uterine devices. According to the United Nations Populations Fund (2010), poor and illiterate women do wish to limit their family size, but do not have the economic means for doing so. These women have an unmet need for modern family planning methods because they lack access to modern contraception. Many rural areas do not provide reproductive health care. In most Sub-Saharan African countries, one out of every three pregnancies is unplanned. According to the United Nations Populations Fund (2010), the following measures are quite helpful: A broad coalition of support at the global, national and local levels, adequate and consistent funding to provide universal access to contraception and pertinent information, universal access to contraception education and materials, as well as to sexuality, health and reproductive rights counseling, involving men in promoting family planning, mass media campaigns to educate people on the benefits of family planning, access to a range of safe and effective contraceptive methods in health facilities and through social marketing and local outreach, national and local debate on the rights of men and women in relation to their bodies, health, education and access to economic and social resources.

In addition to variables related to contraceptive use, data were also collected on socio-demographic and economic variables such as type of residential area (rural or urban), language group, race, awareness about contraceptive services, marital status, level of education, level of income, family size, the degree of awareness about family planning services provided by the CTMM, religion and residing together with sexual partner. The

study attempts at quantifying the demand for the various types of modern family planning methods provided to the general population at the various health service centers in the CTMM. Findings from the study would serve as a basis for improving the quality of services provided to vulnerable women of the child bearing age (15 to 49 years). The CTMM aims to implement a comprehensive monitoring and evaluation plan of action with a view to improve modern family planning services to all eligible women and men residing in the four health sub-districts of the CTMM. Findings from the study would assist policy makers and planners for implementing a monitoring and evaluation programme on fulfilling the reproductive needs of men and women in the CTMM.

## **1.2. Background of study**

Although family planning services are provided in four health sub-districts in the City of Tshwane Metropolitan Municipality (CTMM), there is no empirical evidence that shows the degree of utilization of the services provided by the sub-districts. The lack of empirical evidence makes it difficult to allocate resources efficiently and based on demand for the services provided to the general population. The absence of properly conducted research work in this area has been a well known predicament that has hampered progress in implementing monitoring and evaluation programmes on family planning services. Although a few studies have been conducted by researchers working for the South African Department of Health and non-governmental organizations, such studies were based on descriptive and cross-sectional study designs. As such, no impact assessments could be made on the use of contraceptives by women in the childbearing age of 15 to 49 years. The basic reproductive needs, requirements and aspirations of the female population were unknown to policy makers and planners. Prior to April 1994, health and family planning services provided to the black population were grossly inadequate and poorly planned. Following the new political dispensation, the South African Department of Health encouraged the CTMM to accept full responsibility for the provision of primary health care and family planning services to all population groups residing in and around the City of Pretoria. However, this effort failed to produce adequate results due to poor planning, inadequate funding, lack of technical skills required for improving the quality of services provided to black residents of the CTMM, lack of awareness about services provided by the CTMM, lack of empirical evidence on the socio-demographic, economic, family planning and health-related needs of the various population groups residing in the CTMM. Suburbs of the CTMM inhabited by poor, black, unemployed and illiterate people are characterized by poor service delivery, high teenage pregnancy, adverse pregnancy outcomes, large family size, poor infrastructure, abject poverty,

underutilization of modern family planning methods and services, high prevalence of HIV and TB, as well as high unemployment rate.

The CTMM has collaborative agreements and research partnerships with academic and research institutions such as the University of Pretoria, the Gauteng Provincial Department of Health, the Human Sciences Research Council (HSRC), the South African Medical Research Council (MRC), as well as non-governmental organizations that are involved in community-based activities. However, the CTMM has not been able to effectively utilize these collaborations and partnerships due to reliable research findings that show the reproductive needs and requirements of all population groups residing in the City. The CTMM intends to roll out a comprehensive monitoring and evaluation programme with a view to assess progress made in terms of basic health service delivery, the provision of primary health care, and the degree to which the various population groups benefit from community-based intervention programmes. According to the South African Department of Health (2001), municipalities such as the CTMM are expected to accept full responsibility for the provision of basic reproductive and primary health care services. Based on a report produced by the South African Department of Health (2008) however, the quality of primary health care and family planning services provided by local municipalities throughout South Africa including the CTMM is grossly inadequate. The policy guidelines for family planning services issued by the South African National Department of Health (2002) have not been complied with by the majority of local municipalities including the CTMM. The guidelines issued in 2002 by the South African National Department of Health (2002) were based on findings obtained from a confidential enquiry conducted into the causes of maternal deaths of South African mothers. Norms and standards as well as minimum requirements for essential services provided to the South African population by all local municipalities are outlined in a comprehensive guideline issued by the Department of Provincial and Local Government (2002). Although services related to reproductive health, primary health care and family planning are to be provided based on acceptable norms and standards, the CTMM does not have a comprehensive monitoring and evaluation plan that could be used for ensuring the quality of service delivery. As a result, resources are wasted or abused, and service delivery targets are not achieved. The need for improving the quality of primary health care, education, family planning and other services was emphasized by the South African Presidency (2009) in a key policy directive issued to the local municipalities. The South African government has even established a fully fledged Ministry for Monitoring and Evaluation with a view to keep track of the progress made by the various government departments and local municipalities. According to the United Nations Development Programme (2004) and the World Health Organization (2009), the availability of reproductive health services and modern

family planning methods to women in the child bearing age of 15 to 49 years is quite crucial for the overall development and growth of a developing nation such as South Africa. Since the key elements of family planning methods and contraceptives that are suitable for the South African population were first proposed by Sian and Blanc (1997), no significant progress has been made in terms of making modern contraceptives available to women in the child bearing age of 15 to 49 years who need them most, but could not afford them.

Monitoring and evaluation programmes are not fully developed and operational. As a result, it is impossible to measure the degree of success achieved in terms of fulfilling the reproductive needs of women and men residing in the four sub-districts of the CTMM. Although the CTMM has signed various collaborative agreements with outside agencies and institutions, it has no framework that could be used for assessing the benefits accrued from such collaborative partnerships. It is impossible to assess the status-quo because there is no reliable data on the services provided by the CTMM in its four health sub-districts. Monitoring and evaluation programmes are crucial for implementing community-based reproductive health and family planning programmes. Challenges such as poor reproductive health services in suburbs of the CTMM inhabited by blacks, the high prevalence of teenage pregnancy among the black population residing in the CTMM, the high percentage of pregnant adolescents attending antenatal clinics in suburbs such as Mamelodi, and poor attendance of antenatal health care services by black women need to be addressed as a matter of urgency. Although the South African National Department of Health (2002) has instructed local municipalities such as the CTMM to accept full responsibility for the provision of reproductive health modern family planning services, local municipalities have failed to address challenges such as the shortage of skilled manpower, shortage of service delivery outlets, poor counselling services, poor infrastructure and the acute shortage of modern contraceptives. The degree of success achieved by local municipalities such as the CTMM in fulfilling the reproductive needs and requirements of the general population has been grossly inadequate. This study is expected to produce badly needed baseline information on the degree of utilization of modern family planning methods and contraceptives as well as the reproductive needs of the general population residing in the CTMM. The study will help identify key predictors of adverse outcomes of pregnancy among women in the childbearing age of 15 to 49 years. Findings of this study could be used for meeting the reproductive needs of women, and for improving the quality of family planning services provided to the general population in the CTMM.

In general, this research work was motivated by the following key reasons:

- Lack of reliable scientific studies on the reproductive needs and requirements of the general population
- Lack of awareness about family planning services provided by the CTMM
- Poor utilization of family planning services provided by the CTMM at the various service centers
- Failure of health planners and policy makers to prioritize the reproductive needs of the population
- The poor quality of health-related and family planning services provided to poor and black people residing in the CTMM
- A high level of adverse outcomes of pregnancy, especially among the poor population
- The provision of poor quality of health-related and reproductive services to poor and black women residing in the CTMM
- The need to explain the relationship between utilization of modern family planning methods and the spread of sexually transmitted infectious diseases and tuberculosis, especially among the black population of the CTMM
- The absence of a comprehensive monitoring and evaluation programme that could be used for assessing the degree of progress being made in the provision of reproductive health and family planning services

### **1.3 Rationale of study**

Although reproductive health and family planning services are provided by the CTMM to the general population residing in and around the City of Pretoria, the high prevalence of teenage pregnancy and adverse outcomes of pregnancy that is observed among poor black women is cause for concern. Factors that are responsible for the underutilization of services need to be investigated based on a proper and well-designed scientific study. Planners and policy makers are unable to propose feasible and relevant remedial actions due to the lack of empirical evidence. In this regard, this study provides much needed evidence for decision makers and planners.

This is a 6-year long follow-up study of a random sample of 8, 497 women who took part in the study between 2004 and 2009. The women selected for the study constitute a representative sample of all women residing in and around the City of Pretoria (CTMM). As such, results obtained from the study could be generalized to the general population residing in the CTMM. Data were gathered from each participant of the study on a regular basis based on a structured questionnaire and oral interview. The empirical data obtained from this survey provides much needed information on the extent to which reproductive health and family planning services provided by the CTMM are utilized by the target population. Although various small-scale studies have been

conducted by the CTMM and its stakeholders since 2002, almost all such studies have been descriptive and cross-sectional in design. As such, they could not be used for conducting impact assessments.

The study uses advanced statistical techniques that are suitable for cross-sectional as well as longitudinal study designs. Key predictors of adverse outcomes of pregnancy are determined by using survey logistic regression and the Cox Proportional Hazards Model. Odds ratios estimated from logistic regression analysis and hazard ratios estimated from Cox regression are used as epidemiological measures of effect. Adjustment is made for potential confounding variables of study.

#### **1.4 Objectives of study**

The key objectives of this study are the following:

- To collect baseline information on the reproductive health and family planning services offered by the CTMM at the four health sub-districts in and around the City of Pretoria with a view to enable the CTMM to conduct comprehensive monitoring and evaluation programmes for evaluating the quality and outcome of services provided to the general population.
- To assess the degree of utilization of reproductive health and family planning services provided by the CTMM to women of the childbearing age of 15 to 49 years
- To estimate the prevalence of contraceptive use among women aged 15 to 49 years, and to identify the most popular methods being used by women
- To estimate the prevalence of adverse outcomes of pregnancy among women of the childbearing age of 15 to 49 years
- To identify the key predictors of adverse outcomes of pregnancy among women of the childbearing age of 15 to 49 years



- To find out whether there is a statistically significant variation among the 20 health service delivery wards providing family planning services to the general population.
- To find out whether there is a statistically significant variation among the 11 health service delivery facilities providing family planning services to the general population

The study will lead to the identification of key predictors of adverse outcomes of pregnancy among women of the childbearing age of 15 to 49 years residing in and around the City of Pretoria so that where possible, remedial actions could be taken by the CTMM.

### **1.5 Literature review**

The United Nations Population Fund (2009) works with most governments globally, and provides assistance in delivering sexual and reproductive health care throughout the lifecycle of women. Areas of assistance include family planning, antenatal, safe delivery and post-natal care, prevention and appropriate treatment of infertility, prevention of abortion and management of its consequences, treatment of reproductive tract infections, prevention, care and treatment of sexually transmitted infections, including HIV, and providing information, education and counseling, as appropriate, on human sexuality and reproductive health. The United Nations Population Fund (2010) promotes the prevention of violence against women, maternal health, as well as the Millennium Development Goal Number 5 (MDG5) which is a key priority for the CTMM.

In its annual report, the World Bank (2010) calls upon nations of the developing world to provide women of the childbearing age of 15 to 49 years with adequate access to reproductive health care, reproductive health commodity security, the ability for all individuals to obtain and use affordable, quality reproductive health supplies of their choice whenever they need them. This call is consistent with the aims and objectives of the South African National Department of Health (2008).

The Population Council (2010) has reported that women of the childbearing age of 15 to 49 years must be provided with access to modern family planning methods and contraceptives with a view that they have a say on their reproductive functions and human rights. The Council has developed emergency contraception services

that are suitable for poor women who live in Sub-Saharan African countries. The Council insists that the reproductive rights of women are no less important than the human rights of all people living on earth.

The United Nations Children's Fund (UNICEF, 2010) has reported that the right of the child to grow and live a healthy and productive life is inseparable from the right of the mother to have a full say on her reproductive rights, and that women must be empowered so that they utilize modern family planning methods and contraceptives. The report has found that lack of respect for the reproductive rights of the mother is the key obstacle to development in most Sub-Saharan African countries such as South Africa.

The 2010 annual report of the World Health Organization (2010) shows that life expectancy at birth for males and females are 50 and 53 years respectively. The under-five mortality rate for South Africa is 69 per thousand live births. The South African government spends 8.6% of its gross domestic product on providing health services to the general population. Although these figures are relatively better than corresponding figures reported by the WHO (2010) for most other Sub-Saharan African countries, the quality of reproductive health and family planning services provided to black South Africans is not one of the best in Africa.

According to Gray (2008), it is crucially important to assess the perception of teenagers on the advantages and disadvantages of modern family planning methods and contraceptives as the success of service delivery programmes depends on the degree of acceptance afforded to such services. Perception on pregnancy and contraception are significant predictors of risk taking, especially among the unemployed and poor youth residing in most Sub-Saharan African countries such as South Africa. Although reproductive health services are provided to the general population, the services must be accompanied by sex education and the use of modern family planning methods directed at sexually active adolescents. According to Davis and Lopez-Carr (2010), the capacity of a developing nation to alleviate abject poverty and unemployment among the youth depends on the success of reproductive health and modern family planning programmes. The authors argue that governments must control the rate at which their population grows, and that women should be empowered to decide family sizes at the level of households. The study conducted by Adamo (2010) in several developing nations of the world clearly shows that development is dependent on the right of women to make reproductive and sexual decisions at the level of households.

The research work done by the Children's Institute (2006), Dorrington, Bradshaw, Johnson & Budlender (2004), and Groenewald, Bradshaw, Dorrington, Bourne, Lauscher & Nannan (2005) has highlighted the strategic benefits of providing reproductive health and family planning services to women of the childbearing age in South Africa. According to the authors, local municipalities such as the CTMM must make the resources available for empowering teenagers and young women so that they can make important reproductive decisions at the household level. The authors recommend a community based approach for educating teenagers on the importance of safe sex and the use of contraceptives, along with monitoring and evaluation programmes for assessing the progress made at regular intervals.

The research work conducted by FAHS (2010) has shown that sex education must be given to teenagers as part of the school curriculum. The author argues that while abstinence from sex prior to marriage is helpful for preventing unwanted pregnancy and the spread of sexually transmitted diseases, sex education and contraceptive use are essential for protecting and empowering adolescent females in all societies. The author points out that in traditional and economically impoverished communities, the reproductive rights of women are often ignored or taken lightly.

Medard and Ostrowska (2010) have shown that periodic abstinence and withdrawal (coitus interruptus) are the most popular methods of contraception in Poland. The authors argue that Emergency contraception (EC) is a method which could be used even in cases when other contraception methods have failed. The authors point out that empowering young women and teenagers to avoid unwanted pregnancies is a crucial element of empowering women.

In a policy statement issued in 2010, the American Academy of Pediatrics (2010) argues that the media and television are exposing young women and teenagers to the risk of unwanted pregnancy and sexually transmitted diseases. According to the authors, adolescents use television, music, movies, magazines, and the internet as important factors in the initiation of sexual intercourse. There is a major disconnect between what mainstream media portray (casual sex and sexuality with no consequences) and what children and teenagers need (straightforward information about human sexuality and the need for contraception when having sex). Television, film, music, and the Internet are all becoming increasingly sexually explicit, yet information on abstinence, sexual responsibility, and birth control remains rare. It is unwise to promote "abstinence-only" sex education when it has been shown to be ineffective and when the media have become such an important source of information about "non-abstinence.

Based on data drawn from 40 countries and a multiple regression analysis, Ijaiya, Raheem, Olatinwo & Ijaiya (2009) have examined the impact of birth control devices on the rate of fertility in sub-Saharan Africa. The authors have reported that the more women use birth control devices, the less will be the fertility rate in sub-Saharan Africa. The result obtained from the study indicates that except for the withdrawal method, methods such as the use of pills, injection, intra uterine device (IUD), condom/diaphragm and cervical cap, female sterilization and periodic abstinence/rhythm fulfilled are quite helpful in avoiding unwanted pregnancies among African women. The authors call for health education on the benefit of birth control devices.

The reproductive needs of most poor and illiterate black South Africans residing in parts of the CTMM such as Mamelodi closely resemble those of rural Bangladeshis. The research work conducted in rural Bangladesh by Kamal and Islam (2010) has shown that men should be encouraged and educated to discuss reproductive and family planning issues with their wives freely and openly. Based on the analysis of the 2004 Bangladesh Demographic and Health Survey data set, the authors found that the contraceptive prevalence rate among currently married non-pregnant women was 61%. The prevalence of modern methods was 49%. Oral pills and periodic abstinence were the most preferred modern and traditional methods, respectively. The age of women, number of living children, having a male child, women's education, religion, membership of non-governmental organizations, and residential area were important determinants of contraceptive use the choice of methods. The authors call upon the Bangladeshi government to promote contraceptives based on doorstep delivery services with a view to reduce the total fertility rate in Bangladesh.

The research work conducted by Isley, Edelman, Kaneshiro, Peters, Nichols & Jensen (2010) shows that there is a significant association between the promotion of abstinence from sex and low utilization of modern contraceptives in the United States. Based on the analysis of data gathered from 1, 150 females living in the United States, the authors have found that there is a statistically significant association between abstinence-only messaging and low use of modern contraceptives.

Poor and illiterate women living in most Sub-Saharan African countries often suffer in terms of avoiding unwanted pregnancies. Poor women often rely on criminal abortion procedures for avoiding unwanted pregnancies. In the process, a large number of women die. According to Nigerian researchers Okonta, Ebeigbe and Sunday-Adeoye (2010), the plight of poor and illiterate women living in Nigerian cities could be improved

significantly if the Nigerian government were to recognize the reproductive needs of impoverished women in Nigeria by liberalizing stringent regulations on abortions. The study calls for the liberalization of abortions in Nigeria as a means of reducing deaths and injuries resulting from criminal abortion procedures. According to the authors, the majority of doctors considered promoting abstinence from pre-marital sex and contraceptive use as the best effective strategy in reducing abortion-related deaths among women in Nigeria. Although the South African constitution allows women to terminate pregnancy, such services are quite costly and not readily available to rural women.

Tanner, Hensel and Fortenberry (2010) have found that young women and teenagers place great importance on their first sexual encounter and virginity, and that sex education helps in protecting them from unwanted pregnancy and sexually transmitted diseases including HIV/AIDS. The authors point out that most developed nations place emphasis on the provision of sex education and family planning services to needy teenagers and young women, whereas most Sub-Saharan African countries do not do the same. In its 2009 annual report, the World Bank (2009) has reported that the majority of Sub-Saharan African countries lack the necessary political commitment that is essential for empowering women in the reproductive age of 15 to 49 years by implementing reproductive health and family planning services.

Abstinence-only education programmes are not always helpful. The provision of family planning services and counselling is equally important. The study by Yang and Gaydos (2010) has found that abstinence-only education programs were found to cause an increase in teen birth rates among white and black teenagers in the United States, and that the sharply increasing Hispanic population in the United States is another driving force for high teen birth rates in the United States. The authors have recommended that future policy and behavioral interventions should focus on promoting and increasing access to contraceptive use. Family planning policies should be crafted to address the special needs of teens from different cultural backgrounds, especially Hispanics.

Based on findings of a research conducted in rural Northern Ghana, West African researchers Achana, Debpuur, Akweongo and Cleland (2010) have argued that poor, rural and illiterate women need special protection from the spread of infectious diseases and HIV/AIDS. Cultural barriers make it almost impossible for such women to refuse having sex with their partners. Such women have no power to determine their ideal family size. The researchers found that such women struggle to find contraceptives and condoms as a means of protection. The

authors argue that national governments must intervene to protect such vulnerable women from abuse. Efforts should be made to facilitate easy access to modern contraceptives and HIV protection by rural women.

This study aims to identify and quantify key socio-economic, demographic and health-related factors that are associated with the reproductive choices made by women of the childbearing age residing in the CTMM. According to Integrated Regional Information Networks (2010), there is a significant association between teenage pregnancy and the spread of sexually transmitted diseases in the general South African population. Perceptions on the advantages and disadvantages of modern family planning methods play a significant role in shaping the attitudes and behavior of sexually active adolescents residing in the CTMM. The prevalence of adverse outcomes of pregnancy depends on the extent to which reproductive health services provided by the CTMM are utilized by sexually active adolescents residing in the city. The study provides much needed empirical data on the personal choices and behaviours of sexually active adolescent women residing in the CTMM.

Since April 1994, the South African society has been welcomed by the world community following the new political dispensation. The South African government has encouraged local municipalities to provide reproductive health and family planning services to the general population. Since 1994, black women of the childbearing age have been exposed to improved primary health care and family planning services. Although these services have been provided to the general population, the degree of utilization of the services has been less than satisfactory. The services have not been supported by social programs in which assistance is provided to young women to teach them about sexuality and contraception. There is a lack of easily available contraceptives and youth friendly services. Based on a report compiled together by the World Health Organization, UNAIDS and the United Nations Children's Fund (2010), the major cause of teenage pregnancy in developing countries such as South Africa is ignorance about proper sexual behavior and the consequences involved. According to the South African National AIDS Council (2010), there is a significant association between failure to use condoms during sexual intercourse and adverse outcomes in teenage pregnancies in and around most metropolitans in South Africa. According to UNAIDS (2010), 47% of males aged 15-19 do not always use a condom with their regular partner, and 40% do not use a condom with their non-regular partners. Boys do not always use condoms because they do not like them. As large as 60% do not always use a condom with their regular partner and 45% do not always use a condom with their other partner. Females claim that they do not use condoms with partners that they know well. A large number of teenage boys are not aware of the correct use of a male condom, while the majority of young girls are not aware of the existence of women condom.

Social traditions also contribute to the causes of teenage pregnancy in South Africa. Rural women regard motherhood as an assertion of status and identity and a way to eliminate any suspicion of infertility. Adolescent children are quite reluctant to ask for condoms that are distributed freely at the service centers. Young girls engage in sexual activities often without protection and without being fully aware of the consequences (World Health Organization, 2009).

As in other developing nations, there are a number of myths that surround pregnancy and sexual activities, and these are further causes of teenage pregnancy in South Africa. Young, illiterate women believe in myths rather than taking medical facts seriously. Studies conducted by the South African National AIDS Council (2010), the South African Human Sciences Research Council (2010), the South African National Department of Health (2009), Budlender, et al (2010) and the United Nations Development Programme (2004) have shown that women in the childbearing age of 15 to 49 years must be provided with reproductive health and family planning services as well as counselling services on sexuality in order to avoid unplanned pregnancies, to protect themselves from sexually transmitted infectious diseases such as HIV/AIDS, and to be productive citizens and active participants in the overall economy.

A report published by the World Health Organization (2009) has pointed out that reproductive health and family planning services must not be demand-driven if poor and illiterate women are to benefit from the services. The report recommends that fulfilling the reproductive rights of women is inseparable from providing essential primary health care services to vulnerable segments of the community. Jewkes (2009) and Dunkle, Jewkes, Brown & Gray (2004) have reported that gender-based violence in South Africa has reached unacceptable proportions, and have called upon the South African government to prioritize the security, survival and reproductive needs of women as a matter of urgency. The authors have argued that violence against women is undermining the state of democracy and basic human rights enshrined in the South African constitution. Such a call is consistent with the declaration made by the South African government (Republic of South Africa, 2008) as well as Treatment Action Campaign (2008). The South African Presidency (2009), the South African National Department of Health (2010) and the South African National AIDS Council (2010) have since committed themselves to make all necessary resources available for promoting reproductive and family planning services to all South African women. In this regard, an international benchmark has been set by the American National Institutes of Health (2007) in which national governments are encouraged and supported to implement integrated family planning services with a view to empower their female populations in terms of basic reproductive health and family planning services.

The South African government has a bilateral agreement with the government of the United States of America that could be exploited fully by the CTMM. According to the American National Institutes of Health (2007), bilateral agreements could be relied upon for soliciting badly needed assistance such as technical expertise, logistics, modern contraceptives, professional counselling services, and monitoring and evaluation programmes directed at disadvantaged communities in the CTMM. However, not enough has been done by the CTMM to benefit from the bilateral agreement between South Africa and the United States. Although the CTMM has established four health sub-districts, the planning of reproductive health services is still poorly developed, and reproductive health services are demand-driven. As a result, the use of modern family planning services and contraceptives is poor. This study aims to produce badly needed quantitative data on the prevalence of contraceptive use in and around the City of Pretoria. The study also aims at assessing the socio-demographic characteristics and reproductive needs of women in the childbearing age of 15 to 49 years residing in the four health sub-districts of the CTMM.

According to the South African Department of Provincial and Local Governments (2002), the CTMM is regarded as a local government. As such, the CTMM is required to comply with section 25 of the Municipal Services Act of 2000 (Act Number 32 of 2000) in which it is responsible for the provision of primary health care and reproductive health services to the general population in the CTMM. The CTMM is a fully-fledged local government or municipality that operates under the Gauteng District Health Services Act of 2000 (City of Tshwane Metropolitan Municipality, 2008). The Act authorizes the CTMM to utilize sound scientific and research techniques and methods for assessing the progress made in terms of service delivery to the general population. In this regard, disciplines such as epidemiology, public health, demography and monitoring and evaluation are crucially needed by employees of the CTMM. The municipality is authorized by law to make sure that service providers comply with norms and standards that are applicable to primary health care and reproductive health services. However, the progress made in this regard by the CTMM is less than satisfactory. There is ample room for improvement. To this end, this study aims at identifying the key challenges that adversely affect the implementation of reproductive health and family planning services by the CTMM in its four health sub-districts.

The CTMM does not have a community-based reproductive health data that is specifically related to its jurisdictional territory that could be used for planning and decision making on strategic issues. Decisions are made arbitrarily by managers who are not informed by empirical evidence or scientific findings. Based on findings obtained from the 2003 South African Demographic and Health Survey (the South African Department



of Health, 2008), 61.2% of all South African women use contraceptives, 60.9% of women in Gauteng Province use contraceptives. The percentage of South African adolescent mothers who use contraception is 13.2%. The corresponding figure for Gauteng Province is 8.9%. Nationally, 16.4% of all South African adolescent females have never been pregnant, and use contraception. The corresponding figure for Gauteng Province is 9.5%.

Total fertility rate is defined as the average number of children that a woman gives birth to in her lifetime, assuming that the prevailing rates remain unchanged. Total fertility rate is one of the most useful indicators of fertility because it gives the best picture of how many children women are currently having. According to the South African Health Systems Trust (2010), the total fertility rate of Gauteng Province in the year 2010 is equal to 2.1. The corresponding figure for South Africa is 2.5. Sexually active adolescent women must be protected from unplanned pregnancies and the spread of infectious diseases such as HIV/AIDS. According to Kleinschmidt, Maggwa, Smit, Beksinska and Rees (2003), 10.5% of sexually active women in South Africa use condoms as a means of protection from unwanted pregnancies and sexually transmitted infections. Failure to provide modern contraceptives to teenagers is closely associated with teenage pregnancy and a large number of female adolescent dropouts from schools. According to WHO/UNAIDS/UNICEF (2010), having a large number of school dropouts and unplanned pregnancies by teenage mothers has the potential for exacerbating the spread of HIV/AIDS as well as poverty at the household level.

The study conducted by Adsera (2004) has shown that there are numerous benefits in managing and closely monitoring fertility rates. The growth of economies in most developed nations is a result of this exercise. Contraceptive use, as a proximate determinant of fertility, plays an important role in reducing fertility rates. Contraceptive Prevalence Rates (CPR) estimates are used for assessing the impact of reproductive health programs in many developing nations. It is in the interest of developing nations in Africa to promote the use of sound family planning methods and modern contraceptives. According to the UNFPA (2010), Contraceptive Prevalence Rates vary regionally from 23% in Africa to 64% in Latin America.

Women's access to reproductive health is often correlated with their relative level of social and economic status. Even in many countries where progress towards universal access to reproductive health has been slow, significant gains have been seen among those women who have a relatively higher economic and social status. In some of these countries, such as Madagascar, there has been significant progress in the last 10 years, but the rates of progress have varied, with the largest gains reported among the more privileged groups. In the same

period, many other countries, such as those with a low contraceptive prevalence rate and a high unmet need for family planning, women from the wealthiest households, women with a secondary or higher education and women in urban areas are far less likely to become mothers, more likely to use contraceptives and less likely to have an unmet need for contraception than their peers who have no education and limited household wealth or who live in rural areas (UNFPA, 2010).

According to Statistics South Africa (2009), 23% of children (17 years of age or younger) live with both parents. This indicator shows the percentage of children in South Africa who are living in the same household or dwelling with both their biological parents. Nearly 13% of all black teenagers in South Africa have experienced pregnancy. The corresponding figures for other population groups in South Africa are significantly lower. The information provided below in Table 2 shows that family planning services are most crucially needed by black and coloured women in South Africa.

**Table 1.5.1: The percentage of teenagers who have ever been pregnant in South Africa by population group**

Population group	1998	2003
Black	17.8	12.7
Coloured	19.3	10.1
Indian	4.3	2.0
White	2.2	2.4
South Africa	16.4	11.9

Adolescent boys and girls are most affected by the spread of HIV/AIDS pandemic. Adolescent females are the most victims of unplanned pregnancies in South Africa. For this reason, the South African National Department of Health (2010) has identified young people aged 15 to 24 years as a specific target group for all intervention programmes. It is therefore important that safe sexual behavior is encouraged and actively promoted, and that patterns of high risk sexual activity, of which teenage pregnancy is one consequence, are also understood in the context of the spread of HIV/AIDS as well as unwanted pregnancies.

Results obtained from the analysis of the 2003 South African Demographic and Health Survey show that teenage

pregnancy rates were somewhat similar in urban (11%) and non-urban (14%) areas in the year 2003 (Statistics South Africa, 2009). The rate is highest in the Limpopo province (17%), followed by the Northern Cape (15%) and Free State (15%) provinces. The report cautions that the KwaZulu-Natal rate of 2% in 2003 (compared with 17% in 1998) is implausible, and may be partly due to fieldwork problems in that province.<sup>4</sup> Aside from KwaZulu-Natal, five of the nine provinces had lower teenage pregnancy rates in 2003 than in 1998. In 2003, 12% of teenage girls aged 15 to 19 years had ever been pregnant or were pregnant at the time when the 2003 South African Demographic and Health Survey was conducted. This is lower than the reported teenage pregnancy rate of 16% in the 1998 SADHS. The percentage of teenagers who have been pregnant rises rapidly with each year of age from 15 years (2%) to 19 years (27%). As large as 23% of 19-year-old women included in the 2003 SADHS were mothers.

Black (13%) and Coloured (10%) teenagers have higher rates of pregnancies in comparison to other population groups. Factors that can contribute to the number of teenagers who fall pregnant are, for example, gender power imbalance (associated with significantly older partners), early sexual debut, barriers to contraceptive use (rarely used at sexual initiation), and misinformation on sexual health matters. Pregnancy at a very young age may result in pregnancy complications that can lead to the death of the young mother and the baby. Other associated consequences include increased risk of infant morbidity, as well as the possibility of emotional and financial strain for the mother.

The South African National AIDS Council (2010) is the national HIV coordinating body responsible for overseeing the implementation of the National Strategic Plan adopted by the South African Department of Health (2010) for the years 2007 to 2011. The Council operates under the understanding that the spread of HIV/AIDS cannot be curbed unless women are provided with adequate reproductive health and family planning services. The Council relies on local municipalities such as the CTMM for implementing integrated national programmes directed at women in the childbearing age of 15 to 49 years, and has called upon the national government to make more resources available for combating the spread of HIV/AIDS among teenagers and women in general. A recent report released by the South African National AIDS Council (2010) indicates a possible turning point in the spread of HIV/AIDS, with infections decreasing among the youth. Condom use has increased throughout the decade across all age groups, and is highest among younger people, a notable achievement in South Africa's fight against HIV. However, far more needs to be done if the country is to achieve its goal of halving its 2007 infection rate by 2011.

According to Jewkes (2009), the disempowerment of South African women, revealed by high levels of rape and domestic abuse, is a factor in the spread of HIV/AIDS in South Africa. Women who are unable to negotiate safer sex and the use of condoms will inevitably be at a greater risk of HIV. Jewkes (2009) has reported that women who have been physically and sexually assaulted by their partners, as well as those who are in relationships with men who have a greater degree of control over them, are at a higher risk of HIV infection. Although the South African government has improved its degree of assistance to HIV-positive people, the South African Treatment Action Campaign (2008) insists that not enough is being done in this area. In 2007, more than 32,000 children were receiving antiretroviral therapy, a 250% increase on the 2005 figure, though still only meeting half of the estimated need. According to the South African National AIDS Council (2010), a total of 86,270 children were receiving treatment in 2009. According to guidelines set out by the World Health Organization (2009), only 54% of children in need of HIV treatment living in South Africa are currently receiving treatment. The numerous challenges and predicaments encountered by planners working for the CTMM in areas related to health service delivery (Kaufmann, de Wet and Stadler, 2001) are no different from problems encountered in India (Zhang, Tsui and Suchindran, 1999), Uganda (Katende, Gupta and Bessinger, 2003), Morocco (Magnani, Hotchkiss, Mroz, Rous, Eckert and McDavid, 1995) and Thailand (Entwisle, Rindfuss, Guilkey, Chamrathirong, Curran and Sawangdee, 1996). The lessons drawn from the research work done by the above authors is that a developing nation such as South Africa must provide efficient and reliable reproductive health and family planning services to women in the childbearing age of 15 to 49 years in order to safeguard the basic rights of females, and that political commitment from the South African National Department of Health is essential for service delivery programmes to bear fruit. The provision of reproductive health services to women in the childbearing age of 15 to 49 years has a direct impact on the overall economic growth and development of all South Africans.

Based on the report by Hogan, Foreman, Naghavi, Ahn, Wang, Makela, Lopez, Lozano and Murray (2008), the maternal mortality rate of South Africa in the year 2008 was 237 deaths per 100, 000 births. Mattson (2010) argues that South Africa must meet Targets 5A and 5B of its Millennium Development Goals of 2015 that are related to the provision of reproductive health and family planning services. Target 5A refers to the commitment to reduce maternal mortality ratio by 75% by the year 2015 by way of increasing the percentage of births attended by skilled health professionals. Target 5B refers to the commitment to provide universal access to reproductive health by way of improving contraceptive prevalence rate, adolescent birth rate, antenatal health care coverage, and by fulfilling the unmet need for family planning services.

## 1.6 Research questions

The study aims to provide satisfactory answers to the following key research questions:

- What is the percentage of women of the childbearing age of 15 to 49 years residing in and around the City of Pretoria utilizing modern contraceptives or family planning methods?
- What are the top 3 popular choices of contraceptives used by women of the childbearing age of 15 to 49 years residing in and around the City of Pretoria?
- What factors significantly influence contraceptive use among women of the childbearing age of 15 to 49 years residing in and around the City of Pretoria?
- What is the prevalence of adverse outcomes of pregnancy in women of the childbearing age of 15 to 49 years?
- What are the key predictors of adverse outcomes of pregnancy in women of the childbearing age of 15 to 49 years?
- What socioeconomic, demographic, health-related and service-related factors significantly influence the choice of contraceptives?
- Is there a significant variation among the 20 service delivery wards in terms of contraceptive use?
- Is there a significant variation among the 11 service delivery facilities in terms of contraceptive use?

## **CHAPTER 2: METHODS AND MATERIALS**

### **2.1 Study design**

The design of the study is longitudinal. The study was conducted over a 6-year period between 2004 and 2009. The questionnaire of study was filled in by respondents once a year. Observed values of variables were recorded at the end of the study period (31 December 2009). For survival analysis, data gathered between 01 January 2004 and 31 December 2009 was used.

### **2.2. Sample size of study**

The sample size of study was determined using the statistical package **nQuery Advisor** (Elashoff, 2000). The level of significance of study was set at 5%. An exact test for a single percentage was performed. According to the Southern African Regional Poverty network (2004), the percentage of South African women in the childbearing age of 15 to 49 years utilizing at least one modern family planning method in 2004 varied from 52.7% for rural women to 66% for urban women. The power of test was set at 99%. Using the above figures, the adjusted sample size of study became equal to 8, 497 women in the childbearing age of 15 to 49 years residing in and around the City of Pretoria. Multi-stage cluster sampling was used for selecting eligible women from the 4 health sub-districts of the municipality. Thus, a multi-stage cluster random sample of 2, 125 women was drawn from each of the 4 health sub-districts constituting the CTMM. Blacks accounted for 64.7%, whites for 30.1%, and Indian and coloured women for 5.2% of the sample. Eligible households and women were selected using multistage cluster sampling using a sampling frame obtained from Statistics South Africa. Interviews and data collection were conducted by employees of Social Data Collectors cc.

All in all, data were collected from a total of 8, 497 women in the childbearing age of 15 to 49 years residing in and around the City of Pretoria. Out of the 8, 497 women, 3, 547 of them (41.74%) used at least one modern family planning method. The other 4, 950 women did not use any modern family planning method (58.26%).

### **2.3. Sampling technique**

The sampling frame (the list of all women in the childbearing age of 15 to 49 years residing in the four health sub-districts of the CTMM) was obtained from Statistics South Africa. The list consists of 76 enumeration areas that were used by the CTMM for conducting municipal elections held in the year 2000. The list was fairly

complete and up-to-date. A 5-stage cluster sampling with probability proportional to size (PPS) was used for selecting eligible women from the population into the sample. Stage number 1 consisted of the stratification of the CTMM into 4 health sub-districts. Stage number 2 consisted of the stratification of enumeration areas into residential area (urban, rural) and race groups (black, white, coloured, Indian). Stage number 3 consisted of selecting 30 out of 76 enumeration areas based on Probability Proportional to Size (PPS). Stage number 4 consisted of the selection of eligible clusters from each of the 30 enumeration areas based on systematic random sampling. In each of the 30 enumeration areas that were selected, eligible clusters were selected based on systematic random sampling. This was done by calculating a sampling interval,  $k$ , in each of the 30 enumeration areas. The sampling interval ( $k$ ) was calculated by dividing the total number of women in the cluster (total size of cluster) by the number of women selected from the cluster (sample size of cluster). In each enumeration area, all clusters were serially numbered. In each enumeration area, the first eligible cluster was chosen at random by selecting a cluster at random whose serial number lied between 1 and  $k$ . From then on, every  $k^{th}$  cluster was selected. The process of selection was continued until all eligible clusters were chosen in each of the 30 enumeration areas. Two clusters were selected from each enumeration area at random based on simple random sampling. Thus, a total of 60 clusters were selected for the study. Stage number 5 consisted of the selection of eligible households from each of the 60 clusters selected in Stage number 4 above based on simple random sampling. At each household selected for the study, all women who fulfilled the criteria for inclusion in the study were interviewed. At each household, interviews and data collection were conducted by employees of Social Data Collectors cc who were specifically trained for the purpose of the study.

## **2.4 Questionnaire of study**

The questionnaire of study was translated into Afrikaans, Setswana, Zulu and Sotho. The questionnaire was then pre-tested by a team of trained interviewers in two different settings outside of the study area. The list of variables of study below in Section 2.7 shows the questions the respondents have had to answer as part of the study. Data collectors or interviewers were trained before data collection was done on reproductive health services, field procedures, sources of bias during data collection, ethical procedures relevant to data collection, and field work. The fieldwork involved the identification of enumeration areas (EAs) and eligible clusters and households. All in all, 23 fieldworkers, 4 field editors, 2 supervisors, and one overall field manager were employed for conducting field work as part of the study.

## 2.5. Inclusion and exclusion criteria

All women aged between 15 and 49 years residing in the four health sub-districts of the CTMM who fulfilled the criteria of inclusion into the study were selected for the study. Women who were aged below 15 or above 49 years, and women who were diagnosed with mental illness such as mental retardation, schizophrenia, mental retardation or other psychiatric disorders were excluded from the study.

## 2.6. Ethics approval

Ethics approval was obtained from the Research Committee of Tshwane University of Technology School of Business (**Reference: 2011/05/008; Date: 24 May 2011**). All participants took part in the study did so voluntarily. A full explanation on the purpose and benefits of the study was provided to each participant of the study. Informed consent was obtained from each of the participants in the study. Information gathered from the participants of the study was kept confidential.

## 2.7. List of variables of study

### Independent variables of study ( $X_1$ , $X_2$ , ..... , $X_k$ )

Data were gathered from each of the 8, 497 respondents on a large number of independent variables of study that were associated with the use of family planning methods and contraceptives. These variables were classified according to the following categories:

- Individual level variables that describe the socio-economic, demographic, sanitary, as well as health related characteristics of respondents
- Variables related to utilization of modern family planning methods or contraceptives
- Variables related to the sexual behaviour and practice of respondents and their sexual partners
- Variables related to reproductive health and family planning services provided to the general population by the CTMM

Table 2.7.1, below, shows the list of variables in this study along with definitions for the key variables used in this study. Individual level variables constitute socio-economic, demographic and health-related variables that are related to utilization of family planning methods or contraceptives. The list shows the questions the 8, 497 respondents in this study have had to answer as part of the survey.



**Table 2.7.1: List of variables of study and their levels**

<b>Individual level variables and their categories</b>		
1	Age of respondent	<p>The variable <b>age</b> is defined as the age of the respondent in years. The average age is used as a measure of central tendency in view of the fact that the sample size of study is fairly large. For categorical data analysis however, the variable age is categorized into the following 3 age categories:</p> <ol style="list-style-type: none"> <li>1. 15 to 24 (inclusive at both ends)</li> <li>2. 25 to 34 (inclusive at both ends)</li> <li>3. 35 to 49 (inclusive at both ends)</li> </ol>
2	Age of respondent at first sex	The variable <b>age at first sex</b> is used for assessing the percentage of teenagers who are sexually active.
3	Age of respondent at first pregnancy	The variable <b>age at first pregnancy</b> is used for assessing the percentage of teenagers who are pregnant.
4	Highest level of education	<p><b>Highest level of education</b> denotes the highest level of education attained by the respondent. The following 4 categories are used for analyzing level of education:</p> <ol style="list-style-type: none"> <li>1. No education (Less than 1 year of formal education)</li> <li>2. Primary education (Less than or equal to 6 years of formal education)</li> <li>3. Secondary education (Less than or equal to 12 years of formal education)</li> <li>4. Post-secondary (Greater than 12 years of formal education)</li> </ol>
5	Level of income	<p>The variable <b>income</b> is used for assessing the average monthly income earned by the respondent based on an ordinal scale varying from 1 to 5. The following 5 categories of income are based on income categories defined by the South African national Labour Force Survey of 2004 conducted by Statistics South Africa (2004):</p> <ol style="list-style-type: none"> <li>1. Very low (Less than the minimum wage of 1, 200 Rand per month)</li> <li>2. Low (Between 1, 201 and 6, 000 Rand per month)</li> <li>3. Average (Between 6, 001 and 12, 000 Rand per month)</li> <li>4. Above average (Between 12, 001 and 20, 000 Rand per month)</li> <li>5. High (Greater than 20, 000 Rand per month)</li> </ol>
6	Marital Status	<p>The variable <b>marital status</b> has the following 6 categories:</p> <ol style="list-style-type: none"> <li>1. Never married (Respondent has never been married)</li> <li>2. Married (Respondent has been married according to South African Civil Law)</li> </ol>

		<ol style="list-style-type: none"> <li>3. Living together (Respondent lives with a sexual partner with no formal marriage agreement)</li> <li>4. Divorced (Respondent has undergone at least one divorce procedure)</li> <li>5. Separated (Respondent does not live with marriage partner for various reasons, but has no sexual partner, and is not divorced)</li> <li>6. Widowed (Respondent has lost marriage partner to death, and is not living with another sexual partner)</li> </ol>
7	Religion	<p>The variable <b>religion</b> is used for finding out if the respondent has any religious problems discouraging her from utilizing modern family planning methods or contraceptives. This category for <b>Christianity</b> includes all known church denominations in South Africa. According to the South African Christian Information Centre (2010), 79.77% of South Africans are Christians. The variable has the following 8 categories:</p> <ol style="list-style-type: none"> <li>1. Christianity</li> <li>2. Non-religious</li> <li>3. Islam</li> <li>4. Hinduism</li> <li>5. Judaism</li> <li>6. African traditional religion</li> <li>7. Buddhism or Chinese</li> <li>8. Not known</li> </ol>
8	Unwanted	<p>The variable <b>unwanted</b> is used for finding out if the latest pregnancy of the respondent was indeed desired by herself. The variable is dichotomous (yes, no), and has the following 2 categories:</p> <ol style="list-style-type: none"> <li>1. Yes (Latest pregnancy was desired by respondent)</li> <li>2. No (Latest pregnancy was not desired by respondent)</li> </ol>
9	Family size	<p>The variable <b>family size</b> is a measure of how many people live in the household. According to the HSRC (2010), family sizes of greater than 5 are considered large. The variable is dichotomous, and has the following 2 categories:</p> <ol style="list-style-type: none"> <li>1. Less than or equal to 5</li> <li>2. Greater than 5</li> </ol>
10	Employment	<p>The variable <b>employment</b> is a dichotomous variable (yes, no) that is used for finding out if the respondent has had a chance of being employed over the past 12 months. It is assumed that employed women earn money in exchange for their services.</p> <ol style="list-style-type: none"> <li>1. Yes (Respondent has been employed over the past 12 months)</li> <li>2. No (Respondent has not been employed over the past 12 months)</li> </ol>
11	Access	<p>The variable <b>access</b> is a dichotomous variable (yes, no) that is used for finding out if the respondent has a fairly easy access to services provided by the CTMM at service delivery centers. The question is based on the</p>

		<p>perception of the individual respondent.</p> <ol style="list-style-type: none"> <li>1. Yes (Respondent has easy access to service delivery center)</li> <li>2. No (Respondent does not have easy access to service delivery center)</li> </ol>
12	Awareness	<p>The variable <b>awareness</b> is a dichotomous variable (yes, no) that is used for finding out if the respondent is aware of family planning services that are provided by the CTMM.</p> <ol style="list-style-type: none"> <li>1. Yes (Respondent is aware of family planning services provided by the CTMM)</li> <li>2. No (Respondent is not aware of family planning services provided by the CTMM)</li> </ol>
13	Nearby	<p>The variable <b>nearby</b> is a dichotomous variable (yes, no) that is used for finding out if the respondent lives within a 3-km distance from a service delivery center where family planning services are provided by the CTMM. According to norms and standards set out by Statistics South Africa (2007) and the UNDP (2009), distances of 3-kms or less are considered nearby.</p> <ol style="list-style-type: none"> <li>1. Yes (Respondent lives within a 3-km distance from service center)</li> <li>2. No (Respondent does not live within a 3-km distance from service delivery center)</li> </ol>
14	Tapwater	<p>The variable <b>tapwater</b> is a dichotomous variable (yes, no) that is used for finding out if the respondent has access to tap water at home.</p> <ol style="list-style-type: none"> <li>1. Yes (Respondent has access to tap water at home)</li> <li>2. No (Respondent has no access to tap water at home)</li> </ol>
15	Support	<p>The variable <b>support</b> is a 5-point ordinal-scale variable that is used for assessing the level of support the woman enjoys from her sexual partner in utilizing family planning services provided by the CTMM. The variable has the following 5 categories:</p> <ol style="list-style-type: none"> <li>1. No support at all</li> <li>2. Inadequate support</li> <li>3. Moderate support</li> <li>4. Good support</li> <li>5. Full support</li> </ol>
16	Discussion	<p>The variable <b>discussion</b> is a dichotomous variable (yes, no) that is used for finding out if the respondent discusses family planning issues with her sexual partner as often as the need for doing so arises.</p> <ol style="list-style-type: none"> <li>1. Yes (Respondent discusses family planning issues with partner)</li> <li>2. No (Respondent does not discuss family planning issues with partner)</li> </ol>

17	STI	<p>The variable <b>sti</b> is a dichotomous variable (yes, no) that is used for finding out if the respondent has ever had a sexually transmitted infectious disease.</p> <ol style="list-style-type: none"> <li>1. Yes (Respondent has had STI at least once)</li> <li>2. No (Respondent has never had STI so far)</li> </ol>
18	Counselling	<p>The variable <b>counselling</b> is a dichotomous variable (yes, no) that is used for finding out if the respondent has ever had an opportunity for receiving a joint counselling service with sexual partner on family planning matters.</p> <ol style="list-style-type: none"> <li>1. Yes (Respondent has had a joint counselling service at least once)</li> <li>2. No (Respondent has never had a joint counselling service so far)</li> </ol>
19	Trust	<p>The variable <b>trust</b> is a 5-point ordinal-scale variable that is used for assessing the level of trust the woman has on her sexual partner in terms of being faithful to her on sexual matters. The variable has the following 5 categories:</p> <ol style="list-style-type: none"> <li>1. No trust at all</li> <li>2. Inadequate trust</li> <li>3. Moderate trust</li> <li>4. Good trust</li> <li>5. Absolute trust</li> </ol>
20	Flush toilet	<p>The variable <b>flushtoilet</b> is a dichotomous variable (yes, no) that is used for finding out if the respondent has a flush toilet at home.</p> <ol style="list-style-type: none"> <li>1. Yes (Respondent has a flush toilet at home)</li> <li>2. No (Respondent has no flush toilet at home)</li> </ol>
21	Birthever	<p>The variable <b>birthever</b> is a dichotomous variable (yes, no) that is used for finding out if the respondent has ever had a live birth.</p> <ol style="list-style-type: none"> <li>1. Yes (Respondent has had at least one live birth)</li> <li>2. No (Respondent has never had a live birth)</li> </ol>
22	Pregnantever	<p>The variable <b>pregnantever</b> is a dichotomous variable (yes, no) that is used for finding out if the respondent has ever been pregnant.</p> <ol style="list-style-type: none"> <li>1. Yes (Respondent has been pregnant at least once before)</li> <li>2. No (Respondent has never been pregnant before)</li> </ol>
23	Parity	<p>The variable <b>parity</b> denotes the total number of children (children who are still alive) that have been born to the respondent.</p>
24	Gravidity	<p>The variable <b>gravidity</b> denotes the total number of deliveries the respondent has had regardless of the outcome of the pregnancy.</p>
25	Partnernow	<p>The variable <b>partnernow</b> is a dichotomous variable (yes, no) that is used for finding out if the respondent has a sexual partner now.</p>

		<ol style="list-style-type: none"> <li>1. Yes (Respondent has a sexual partner now)</li> <li>2. No (Respondent does not have a sexual partner now)</li> </ol>
26	Partnerlive	<p>The variable <b>partnerlive</b> is a dichotomous variable (yes, no) that is used for finding out if the sexual partner of the respondent currently lives with the respondent.</p> <ol style="list-style-type: none"> <li>1. Yes (Sexual partner of respondent lives with respondent now)</li> <li>2. No (Sexual partner of respondent does not live with respondent now)</li> </ol>
<b>Service delivery variables and their levels</b>		
27	Source	<p>The variable <b>source</b> denotes the primary source of supply of the respondent where contraceptives are obtained regularly. The variable has the following 3 possible values:</p> <ol style="list-style-type: none"> <li>1. Public enterprises such as public hospitals, clinics or schools</li> <li>2. Private enterprises such as private hospitals, clinics or schools</li> <li>3. Private pharmacies</li> </ol>
28	Info	<p>The variable <b>info</b> denotes the primary source of information in which the respondent came to know about contraceptives and family planning services provided by the CTMM. The variable has the following 10 possible values:</p> <ol style="list-style-type: none"> <li>1. Mother</li> <li>2. Father</li> <li>3. Sister</li> <li>4. Close family relative such as aunt, uncle, cousin or grandparent</li> <li>5. Friend</li> <li>6. Teacher</li> <li>7. Nurse</li> <li>8. Medical Doctor or physician</li> <li>9. Leaflet or magazine</li> <li>10. Radio or television</li> </ol>
29	District	<p>The variable <b>district</b> denotes the health sub-district of the respondent within the City of Tshwane Metropolitan Municipality (CTMM). The 4 possible values of the variable are the following:</p> <ol style="list-style-type: none"> <li>1. District 1 denotes Central and Western areas of the CTMM</li> <li>2. District 2 denotes Eastern areas of the CTMM</li> <li>3. District 3 denotes North-Eastern areas of the CTMM</li> <li>4. District 4 denotes North-Western areas of the CTMM</li> </ol>
30	Wards	<p>The variable <b>wards</b> denotes the service delivery ward (1, 2, ....., 20) in which respondent is provided with family planning services regularly. There are 20 wards in the CTMM that provide family planning services to the general population.</p>

31	Facilities	The variable <b>facilities</b> denotes the type of facility (1, 2, ....., 11) in which respondent is provided with family planning services regularly. There are 11 types of facilities in the CTMM that provide family planning services to the general population. These are: public clinics, public hospitals, surgeries, pharmacies, private hospitals, educational facilities, public facilities, non-governmental organizations, private clinics, midwives, and faith-based institutions.
32	Satisfaction	<p>The variable <b>satisfaction</b> is a 5-point ordinal-scale variable that is used for assessing the level of satisfaction the woman has with the quality of services provided to her by the CTMM. The variable has the following 5 categories:</p> <ol style="list-style-type: none"> <li>1. No satisfaction at all</li> <li>2. Inadequate satisfaction</li> <li>3. Moderate satisfaction</li> <li>4. Good satisfaction</li> <li>5. Total satisfaction</li> </ol>
<b>Outcome or dependent variables of study</b>		
33	fpuse	<p>The variable <b>fpuse</b> is a dichotomous variable (yes, no) that is used for finding out if the respondent uses at least one modern contraceptive.</p> <ol style="list-style-type: none"> <li>1. Yes (Respondent uses at least one contraceptive)</li> <li>2. No (Respondent does not use any contraceptive)</li> </ol>
34	Regular	<p>The variable <b>regular</b> is a dichotomous variable (yes, no) that is used for finding out if the respondent uses family planning services or contraceptives regularly.</p> <ol style="list-style-type: none"> <li>1. Yes (Respondent uses FP services or contraceptives regularly)</li> <li>2. No (Respondent does not use FP services or contraceptives regularly)</li> </ol>
35	Choice	<p>The variable <b>choice</b> refers to the type of contraceptive used by the respondent. The variable has the following 6 categories:</p> <ol style="list-style-type: none"> <li>1. Injections</li> <li>2. Pills</li> <li>3. Condoms</li> <li>4. Intra-Uterine Devices (IUDs)</li> <li>5. Sterilization</li> <li>6. Vaginal foam</li> </ol>
36	Adverse	<p>The variable <b>adverse</b> is a dichotomous variable (yes, no) that is used for finding out if the respondent has ever had a miscarriage.</p> <ol style="list-style-type: none"> <li>1. Yes (Respondent has had at least one miscarriage)</li> <li>2. No (Respondent has never had a miscarriage)</li> </ol>

### **Outcome variables of study ( $Y_1$ , $Y_2$ and $Y_3$ )**

The study uses the following 3 outcome variables of study for providing answers to the research questions of the study.

#### **Outcome variable 1 of study ( $Y_1$ )**

The following dichotomous outcome variable of study was used for estimating the percentage of respondents utilizing one or more modern family planning methods or contraceptives.

$$Y_1 = \begin{cases} 1 & \text{if respondent uses at least one type of contraceptive} \\ 0 & \text{otherwise} \end{cases}$$

The outcome variable of study shall enable us to provide answers to the following research questions:

- What is the percentage of women of the childbearing age of 15 to 49 years residing in and around the City of Pretoria utilizing modern contraceptives or family planning methods?
- What are the top 3 popular choices of contraceptives used by women of the childbearing age of 15 to 49 years residing in and around the City of Pretoria?
- What factors significantly influence contraceptive use among women of the childbearing age of 15 to 49 years residing in and around the City of Pretoria?

#### **Outcome variable 2 of study ( $Y_2$ )**

The following dichotomous outcome variable of study was used for estimating the percentage of respondents who have experienced an adverse outcome of pregnancy. This outcome variable of study is designed for estimating the percentage of women who have had adverse outcomes of pregnancy. The outcome variable of study is also useful for identifying the key predictors of adverse outcomes of pregnancy. The outcome variable of study will be used for performing Pearson's chi-square tests of associations, logistic regression analysis, and Cox regression.

$$Y_2 = \begin{cases} 1 & \text{if respondent has lost a fetus} \\ 0 & \text{otherwise} \end{cases}$$

The outcome variable of study shall enable us to provide answers to the following research questions:

- What is the prevalence of adverse outcomes of pregnancy in women of the childbearing age of 15 to 49 years?
- What are the key predictors of adverse outcomes of pregnancy in women of the childbearing age of 15 to 49 years?
- What socioeconomic, demographic, health-related and service-related factors significantly influence the choice of contraceptives?

### **Outcome variable 3 of study ( $Y_3$ )**

The following discrete outcome variable of study was used for assessing the presence of significant differences among health service delivery wards (1, ..., 20) and health service delivery facilities (1, ..., 11). This outcome variable of study is designed for performing multilevel analysis by using the 20 health service delivery wards and the 11 health service delivery facilities as hierarchical levels.

$$Y_3 = \begin{cases} 1 & \text{if respondent uses injections} \\ 2 & \text{if respondent uses pills} \\ 3 & \text{if respondent uses condoms} \\ 4 & \text{if respondent uses IUD} \\ 5 & \text{if respondent uses sterilization} \\ 6 & \text{if respondent uses vaginal foam} \end{cases}$$

The outcome variable shall help us answer the following research questions:

- Is there a significant variation among the 20 service delivery wards in terms of contraceptive use?
- Is there a significant variation among the 11 service delivery facilities in terms of contraceptive use?



## **2.8 Statistical methods of data analysis**

Data analysis was conducted in the following 5 methods of data analysis (univariate analysis, bivariate analysis, logistic regression analysis, survival analysis, and multilevel analysis). In what follows next, each of these 5 methods of data analysis shall be discussed briefly.

### **(1) General characteristics of respondents**

Univariate methods of statistical data analysis were used for describing the general characteristics of respondents in the study. This was done by obtaining summary statistics and frequency tables for the 8, 497 respondents in the study. Summary statistics such as averages, standard deviations, and box plots were obtained for continuous variables of study; and frequency tables, bar charts and pie charts were obtained for categorical variables. The purpose of univariate analysis is to understand the general socio-economic and demographic characteristics of the respondents in the study. In univariate analysis, categorical variables are presented based on simple frequency tables, bar charts and pie charts, whereas continuous or interval-scale variables are summarized based on averages, standard deviations, box plots and histograms. Continuous variables of study such as age in years are broken down into categories for the purpose of summarizing or presenting valuable information in tabular form.

### **(2) Pearson's chi-square tests of associations**

Bivariate methods of statistical data analysis were used for screening variables. One commonly used bivariate method of statistical data analysis is the Pearson chi-square test of association (Dawson and Trapp, 2004). At the 5% level of significance, statistically significant tests of associations are characterized by P-values that are smaller than 0.05. In this study, this method is used for screening useful variables. The Pearson chi-square test of association works quite well in cases where it is desired to obtain a P-value for the association between two dichotomous variables. In such cases, expected cell frequencies that are obtained from Pearson chi-square tests of associations must be greater than or equal to 5 in order for the tests to be valid. The statistical package STATA (STATA Corporation, 2010) Version 11 was used for performing Pearson's chi-square tests of associations in this study.

### (3) Logistic regression analysis with the random effects model

The first multivariate method of statistical data analysis is logistic regression analysis. According to Kleinbaum & Klein (2002) and Hosmer & Lemeshow (2002), logistic regression analysis is most suitable for the analysis of categorical outcome variables of study. In this study, logistic regression analysis is used for identifying key predictors of contraceptive use (yes, no), as well as adverse outcomes of pregnancy (yes, no). To identify the key predictors of contraceptive use, data gathered from the entire sample (n=8, 497 respondents) was used. This was because out of the 8, 497 respondents in the study, 3, 547 of them (41.74%) used contraceptives, whereas the remaining 4, 950 (58.26%) did not use contraceptives. As such, the outcome variable of study (utilization of contraceptives) becomes dichotomous (yes, no). The regression of contraceptive use on k predictor variables constitutes a binary logistic regression model.

In cases where the outcome variable Y is not continuous or discrete, the relationship between Y and the predictor variables that affect Y is explored by using a non-linear regression procedure. In this study, the outcome variable of study,  $Y_2$ , has 2 categories:

$$Y_2 = \begin{cases} 1 & \text{if respondent has lost a fetus} \\ 0 & \text{otherwise} \end{cases}$$

The regression of the outcome variable  $Y_2$  on 2 or more predictor variables constitutes binary logistic regression analysis.

In this study, the outcome variable of study,  $Y_3$ , has 3 or more categories:

$$Y_3 = \begin{cases} 1 & \text{if respondent uses injections} \\ 2 & \text{if respondent uses pills} \\ 3 & \text{if respondent uses condoms} \\ 4 & \text{if respondent uses IUD} \\ 5 & \text{if respondent uses sterilization} \\ 6 & \text{if respondent uses vaginal foam} \end{cases}$$

The regression of the outcome variable  $Y_3$  on 2 or more predictor variables constitutes multinomial logistic regression analysis.

The measure of effect in logistic regression analysis is the odds ratio (OR). For binary logistic regression analysis, the outcome variable of study has only 2 possible values. That is,

$$Y = \begin{cases} 1 & \text{if event occurs} \\ 0 & \text{otherwise} \end{cases}$$

$X_1, X_2, \dots, X_k$  are a combination of k discrete and continuous explanatory variables that affect the outcome variable Y.

An estimated regression coefficient is denoted by  $\hat{\beta}$ . In logistic regression analysis, a regression coefficient is estimated for each explanatory variable included in the model. In general, the binary logistic regression of a dichotomous outcome variable Y on a combination of k discrete and continuous independent variables  $X_1, X_2, \dots, X_k$  is defined by the following logit function:

$$\log it(p_i) = \ln\left(\frac{p_i}{1-p_i}\right) = \hat{\beta}_0 + \hat{\beta}_1 X_1 + \dots + \hat{\beta}_k X_k$$

### Interpretation of odds ratios

The odds ratio corresponding to the  $i^{th}$  explanatory variable  $X_i$  is equal to  $\exp(\hat{\beta}_i)$  where  $\hat{\beta}_i$  denotes the estimated regression coefficient corresponding to  $X_i$ .

#### Case 1:

If  $\hat{\beta} > 0$ , then  $\exp(\hat{\beta}) > 1$ . In this case, the odds of Y=1 are increased by a factor of  $\exp(\hat{\beta})$ .

#### Case 2:

If  $\hat{\beta} < 0$ , then  $\exp(\hat{\beta}) < 1$ . In this case, the odds of Y=1 are decreased by a factor of  $\exp(\hat{\beta})$ .

#### Case 3:

If  $\hat{\beta} = 0$ , then  $\exp(\hat{\beta}) = 1$ . In this case, the odds of Y=1 remain unchanged.

At the 5% level of significance, significant odds ratios are characterized by P-values that are smaller than 0.05, estimated odds ratios that differ from 1 significantly, and 95% confidence intervals of true odds ratios that do not contain 1.

The random effects model was assumed while using binary logistic regression analysis in order to account for correlations between responses provided by the same individual respondent over time. Analysis was performed by using the **Xtlogit** procedure of the statistical package STATA with the **re** (random effects) option (STATA Corporation, 2010). By using the random effects model, it was possible to estimate the Intra Class Correlation coefficient (ICC) which is a descriptive measure of how strongly individual women in the same group resemble each other (Rodriguez, 2003). The ICC coefficient has been properly defined and explained in Section 3.3. Table 3.3.1 shows estimates obtained from binary logistic regression analysis based on the random effects assumption. Just below Table 3.3.1, the estimated value of the ICC coefficient (rho) is shown to be 0.8937 = 89.37%. This high figure shows that individual women in the same group resemble each other fairly well.

The objective of binary logistic regression analysis was to identify factors that significantly influence utilization of modern family planning methods and contraceptives. The random effects model was assumed in order to account for correlations between responses provided by the same individual respondent over time. Analysis was performed by using the **Xtlogit** procedure of the statistical package STATA with the **re** (random effects) option. By using the random effects model, it was possible to estimate the Intra Class Correlation coefficient (ICC) which is a descriptive measure of how strongly individual women in the same group resemble each other (Rodriguez, 2003).

Under the random effects model  $Y_{ij} = \mu + \alpha_i + \varepsilon_{ij}$  where  $Y_{ij}$  is the  $j^{th}$  observation in the  $i^{th}$  group,  $\mu$  is an unobserved overall mean,  $\alpha_i$  is an unobserved random effect shared by all values in group  $i$ , and  $\varepsilon_{ij}$  is an unobserved noise term. For the model to be identified,  $\alpha_i$  and  $\varepsilon_{ij}$  are assumed to have expected value zero and to be uncorrelated with each other. Also, both  $\alpha_i$  and  $\varepsilon_{ij}$  are assumed to be identically distributed. The

population ICC in this framework is given by  $ICC = \rho = \frac{\sigma^2_{\alpha}}{\sigma^2_{\alpha} + \sigma^2_{\varepsilon}}$

The hierarchical stepwise backward elimination technique proposed by Kleinbaum and Klein (2002) was used as a means for obtaining a “gold standard parsimonious model” and removing potential confounding and effect-modifying variables from the optimal model used for data analysis.

### **Diagnostic procedures for logistic regression models**

Diagnostic procedures are used for assessing the degree of reliability of fitted models. Fitted models cannot be used without establishing that they are theoretically reliable. The following standard diagnostic procedures were used for testing the reliability of fitted logistic regression models in this study: The classification table, the likelihood ratio test, sensitivity and specificity tests, the Hosmer-Lemeshow goodness-of-fit test (Hosmer and Lemeshow, 2002), and Receiver Operating Characteristic (ROC) plots.

The classification table is used for assessing the predictive capacity of the fitted logistic regression model. The table provides the percentage of overall correct classification. A fitted model that correctly classifies 75% or more observations is considered fairly reliable (Hosmer and Lemeshow, 2002). The likelihood ratio test is used for assessing the collective efficiency of the predictor variables that constitute the fitted model. At the  $\alpha$  level of significance, the predictor variables constituting the fitted model are said to be collectively efficient if  $P < \alpha$ . The predictor variables constituting the fitted model are said to be collectively inefficient if  $P \geq \alpha$ . The individual significance of each predictor variable in the fitted model is assessed based on the Student's t-test. At the  $\alpha$  level of significance, a predictor variable in the fitted model is said to be significant if  $P < \alpha$ . It is said to be insignificant if  $P \geq \alpha$ . Sensitivity is a measure of the ability of the fitted model to accurately detect women who are at risk of adverse outcomes of pregnancy. Specificity is a measure of the ability of the fitted model to accurately detect women who are not at risk of adverse outcomes of pregnancy. The Hosmer-Lemeshow goodness-of-fit test is used for finding out if there is enough reason to doubt the reliability of the fitted logistic regression model. The null hypothesis states that there is no reason to doubt the reliability of the fitted model. The alternative hypothesis states that there is enough reason to doubt the reliability of the fitted model. At the  $\alpha$  level of significance, the null hypothesis is rejected if  $P < \alpha$ . The null hypothesis cannot be rejected if  $P \geq \alpha$ . The magnitude of area that lies under the ROC curve is a measure of variation explained by the fitted logistic regression model. Areas under the ROC curve with magnitudes of 75% or above indicate that the percentage of variation explained by the fitted model is fairly adequate.

#### (4) Survival analysis based on Cox regression

The objective of performing survival analysis was to identify factors that significantly affect the occurrence of an adverse outcome of pregnancy among women in the childbearing age category of 15 to 49 years. Analysis was done using the Cox proportional hazards model (Cleves, Gould & Gutierrez, 2004) in view of the fact that some of the 8,497 women in the study were right censored. Hazard ratios were obtained for key influential predictors of adverse outcomes of pregnancy. Kaplan-Meier survival probability curves were used for comparing women who experienced adverse outcomes of pregnancy with those who did not experience adverse outcomes of pregnancy in the 6-year period of study. Descriptive and summary statistics were also obtained. The adequacy of the fitted Cox regression model was assessed using the likelihood ratio test and Akaike's information criterion (AIC) statistic. The fulfillment of the proportional hazards assumption was tested by use of log-minus-log plots. Data analysis was done using the statistical package STATA version 11 (STATA Corporation, 2010).

The duration of survival of respondents was measured for each of the 8,497 respondents in the study by using 01 January 2004 as the starting point. Women who had not yet experienced any adverse outcome of pregnancy at the end of the study period (31 December 2009) were considered right-censored observations as their exact durations of survival could not be measured due to administrative censoring at the end of the study period. For women that experienced adverse outcomes of pregnancy prior to 31 December 2009, survival time was defined as the number of days between 01 January 2004 and the date on which an adverse outcome of pregnancy was experienced.

$X_1, X_2, \dots, X_{12}$  denote the 12 explanatory variables that were used for survival analysis.

The indicator of censoring,  $\delta$ , is defined as follows:

$$\delta = \begin{cases} 1 & \text{if respondent has lost a fetus} \\ 0 & \text{otherwise} \end{cases}$$

The Cox Proportional Hazards Model takes censored observations into account, and this property of the model makes it quite attractive in comparison with other models used for survival analysis in economic studies (Cleves, Gould & Gutierrez, 2004; Kleinbaum, 1996). In Cox regression, hazard ratios are used as a measure of effect. Key predictors of survival are identified and estimated based on hazard ratios. Kaplan-Meier survival probability curves were used for comparing women who lost foetus with those who did not lose foetus with regards to key predictor variables such as the use of modern contraceptives.

## Kaplan-Meier survival probabilities

The Kaplan-Meier product limit technique (Kleinbaum, 1996) is the recognized approach for calculating survival curves in such studies. Suppose that the survival times after entry to the study (ordered by increasing duration) of a group of  $n$  businesses denoted by  $t_1, t_2, \dots, t_n$  are given. The percentage of businesses surviving beyond any follow up time ( $t$ ) is estimated by the Kaplan-Meier technique as:

$$\hat{p} = \prod_{i=1}^n \frac{r_i - d_i}{r_i} \quad \text{where}$$

$\hat{p}$  is the percentage of women surviving beyond any follow up time  $t$

$r_i$  is the number of women who have survived just before time  $t_i$  (the  $i^{th}$  ordered survival time)

$d_i$  is the number of women who have failed at time  $t_i$

The standard error of  $\hat{p}$  is given by:

$$SE(\hat{p}) = \sqrt{\frac{\hat{p}(1 - \hat{p})}{n'}} \quad \text{where}$$

$n' = n -$  number of women lost to follow up before time  $t$   
= Effective sample size at time  $t$

A  $100(1 - \alpha)\%$  confidence interval for the true survival percentage  $P$  at time  $t$  is given by:

$$P \in [\hat{p} \pm Z_{1 - \frac{\alpha}{2}} \times SE(\hat{p})]$$

## The Cox Proportional Hazards Model

The hazard function for the Cox Proportional Hazards Model (Cleves, Gould & Gutierrez, 2004) is given by:

$h(t, X) = h_0(t) \exp\left(\sum_{i=1}^p \beta_i X_i\right)$  where  $X = (X_1, \dots, X_p)$  is a collection of  $p$  explanatory variables that affect survival time.

The Cox model uses survival times and censoring for the estimation of parameters. In Cox regression, the measure of effect is the hazard ratio, which involves only the  $\beta$ 's. Estimates of the  $\beta$ 's are maximum likelihood estimates.

$h_0(t)$  is the baseline hazard function. It involves  $t$ , but not the  $X$  variables. For the Cox Proportional Hazards Model,  $h_0(t)$  is obtained by replacing all the  $X$  variables in  $h(t, X)$  by zeroes. The proportional hazards assumption requires that the hazard rate is constant over time, or equivalently, that the hazard for one individual is proportional to the hazard for any other individual, where the proportionality constant is

independent of time. The assumption of proportional hazards is tested using log-minus-log plots. Parallel curves show that the assumption is satisfied, while non-parallel curves show that the assumption is violated (Cleves, Gould & Gutierrez, 2004).

The expression  $\exp\left(\sum_{i=1}^p \beta_i X_i\right)$  involves the X variables, but not t. The X variables do not depend on the time t.

The Cox proportional hazards model is non-parametric because  $h_0(t)$  is unspecified.

In the Cox proportional hazards model, the hazards ratio is estimated by

$$\begin{aligned} HR &= \frac{\hat{h}(t, X^*)}{\hat{h}(t, X)} = \exp\left[\sum_{i=1}^p \hat{\beta}_i (X_i^* - X_i)\right] \\ &= \exp\left[\hat{\beta}_1 (X_1^* - X_1) + \hat{\beta}_2 (X_2^* - X_2) + \dots + \hat{\beta}_p (X_p^* - X_p)\right] = \theta \quad (\text{Constant}) \end{aligned}$$

The expression for the hazard ratio does not involve the time t, because the baseline hazard has cancelled out.

$$\hat{h}(t, X^*) = \hat{\theta} \hat{h}(t, X)$$

Note that  $\hat{\theta}$  is a constant of proportionality, and does not depend on the time t.

At the 5% level of significance, influential predictors of survival are characterized by hazard ratios that differ from 1 significantly, 95% confidence intervals of hazard ratios that do not contain 1, and P-values that are smaller than 0.05.

## (5) Multilevel analysis

The objective of performing multilevel analysis (Skron dal & Rabe-Hesketh, 2004) was to find out if there was a significant difference among the 20 service delivery wards and among the 11 health facilities. Multilevel analysis is a statistical method that allows the use of mixed models (fixed and random effects could be analyzed simultaneously) for estimating variance components that are a measure of variation that occurs at each



hierarchical level. As such, multilevel analysis enables us to find out if the quality of family planning services provided to the general population vary from facility to facility, or from ward to ward? If so, what is the component of variance that is attributed to variation at the level of the 20 service delivery wards, and at the level of the 11 health facilities? The main advantage of using multilevel analysis is that the provision of family planning services is hierarchical in nature. That is, FP users are nested within facilities, and facilities are nested within wards. Traditional multiple linear regression models (OLS) underestimate the standard error of estimation because the assumption of independence of observations is violated (Diggle, Heagerty, Liang & Zeger, 2002). The ability to quantify the percentage of variance attributed to differences at the levels of facilities and wards enables planners and policy makers working for the CTMM to allocate scarce resources that are needed for intervention based on an objective assessment of actual need at each hierarchical level.

A 3-level analysis is performed for the  $n = 3,547$  modern FP users only.

Level 1 represents the individual woman utilizing FP methods.

Level 2 represents the facility level. There are 11 health facilities rendering FP services. The 11 health facilities are considered to be random although 11 is not a large sample size. This could be taken as a minor limitation of study.

Level 3 represents the 20 health service wards.

#### **List of 8 predictor variables used in multilevel analysis**

- Access to FP services
- Degree of support from sexual partner based on a 2-point ordinal scale
- Age at first pregnancy
- Counselling services
- Family size
- Availability of nearby FP services
- Discussion of FP matters with sexual partner
- Degree of satisfaction with FP services based on a 5-point ordinal scale

Each of the above 8 independent variables of study has been shown to be a highly influential predictor of FP use based on results obtained from logistic regression analysis. As such, the use of the 8 independent variables in

multilevel analysis for the purpose of assessing the extent of variability at the levels of wards and facilities is appropriate (Diggle, Heagerty, Liang & Zeger, 2002).

### **Outcome variable used in multilevel analysis**

The following discrete outcome variable of study was used for assessing the presence of significant differences among health service delivery wards (1, ..., 20) and health service delivery facilities (1, ..., 11). This outcome variable of study is designed for performing multilevel analysis by using the 20 health service delivery wards and the 11 health service delivery facilities as hierarchical levels.

$$Y_3 = \begin{cases} 1 & \text{if respondent uses injections} \\ 2 & \text{if respondent uses pills} \\ 3 & \text{if respondent uses condoms} \\ 4 & \text{if respondent uses IUD} \\ 5 & \text{if respondent uses sterilization} \\ 6 & \text{if respondent uses vaginal foam} \end{cases}$$

The outcome variable shall help us answer the following research questions:

- Is there a significant variation among the 20 service delivery wards in terms of contraceptive use?
- Is there a significant variation among the 11 service delivery facilities in terms of contraceptive use?

### **Research questions to be answered by performing multilevel analysis**

- Does FP choice vary by facility?
- Does FP choice vary by ward?
- Are the 8 predictor variables used for multilevel analysis influential over FP choice?

### **Properties of statistical model used for multilevel analysis**

- Type of modern FP method (1, ..., 6) as an outcome variable of study (Y)
- Eight independent variables of study that significantly influence FP use are used as independent variables of study based on findings from logistic regression analysis
- Level 1 is the individual woman (1, ..., 3547)
- Level 2 is FP facility (1, ..., 11)
- Level 3 is service delivery ward (1, ..., 20)

- Multilevel analysis based on a hierarchical nested design model
- Women are nested within health facilities
- Facilities are nested within service delivery wards
- The variable facility was assumed to be random because the number of facilities per ward was  $11 > 10$
- Variability among wards and FP facilities compared using Intra Class Correlation (ICC)
- Adjustment was made for clusters

### Statistical model for 3-level analysis based on mixed modelling

$y = X\beta + ZU + \varepsilon$  where  $y$  is an  $n \times 1$  vector of responses where

$X$  is an  $n \times p$  covariate matrix of fixed effects  $\beta$ ,

$Z$  is an  $n \times q$  covariate matrix of random effects  $U$ , and

$$\varepsilon \sim NID(0, \sigma^2 I_n)$$

### Elements of the variance-covariance matrix G

Let  $G$  denote the variance-covariance matrix of  $U$ . Let  $U$  be orthogonal to  $\varepsilon$ . Then we have that

$$Var \begin{pmatrix} U \\ \varepsilon \end{pmatrix} = \begin{bmatrix} G & 0 \\ 0 & \sigma^2 I_n \end{bmatrix}$$

### Model for combined error term

$y \sim NID(X\beta, V)$  where  $V_{n \times n} = ZGZ' + \sigma^2 I_n$  denotes the variance-covariance matrix.

The **unrestricted** maximum likelihood estimator (MLE) used for analysis is given by:

$$L(\beta, \theta, \sigma^2_\varepsilon) = -\frac{1}{2} \{ n \log(2\pi) + \log |V| + (y - X\beta)' V^{-1} (y - X\beta) \}$$

The **restricted** maximum likelihood estimator is a function of the unrestricted MLE estimator, and is given by the following expression:

$$L_R(\beta, \theta, \sigma^2_\varepsilon) = L(\beta, \theta, \sigma^2_\varepsilon) - \frac{1}{2} \log |X'V^{-1}X|$$

### Intra Class Correlation (ICC)

$$ICC = \frac{\sigma^2_v}{\sigma^2_v + \sigma^2} = \frac{\text{Cluster variance}}{\text{Total variance}} \text{ where}$$

$\sigma^2_v$  = Cluster variance, and  $\sigma^2$  = Error variance, where

$V_i \sim NID(0, \sigma^2_v)$  = Cluster effects and  $\varepsilon_i \sim NID(0, \sigma^2 I_n)$  = Vector of residuals  
 $i = 1, \dots, n$

### Properties of ICC

ICC measures intra-unit correlation, similarity within clusters and unexplained variation due to clusters. ICC has the following 3 useful properties:

$$0 \leq ICC \leq 1$$

$$ICC = 0 \text{ if } \sigma^2_v = 0$$

$$ICC = 1 \text{ if } \sigma^2 = 0$$

The percentage of variance attributed to differences among the 20 service delivery wards as well as the 11 health facilities shall be estimated. The reliability of the fitted model is assessed based on the likelihood ratio test.

## CHAPTER 3: RESULTS OF STUDY

In what follows next, results obtained from statistical data analysis shall be presented in sequence. This section presents 6 sets of results corresponding to each of the 6 statistical methods of data analysis used in the study.

### 3.1: General characteristics of respondents

The study consists of a total of 8, 497 women in the childbearing age of 15 to 49 years who lived in 2, 075 households scattered over the four health sub-districts of the CTMM. Out of the 8, 497 women who took part in the study, 3, 547 women (41.74% of them) utilized at least one modern family planning (FP) method such as contraceptives regularly. The remaining 4, 950 women (58.26%) did not utilize any modern family planning method. The average age of FP users at first sex was 18.72 years. The average age of FP users at first pregnancy was equal to 19.36 years. The prevalence of teenage pregnancy among the 8, 497 women in the study was equal to 9.5%. The prevalence of adverse outcomes of pregnancy among the 8, 497 women in the study was equal to 12.19%. The average number of women in the childbearing age per household varies from 2.4 women in district 1, to 2.0 women in district 4, and to 1.5 women in districts 2 and 3, respectively. The average number of persons per household is 4.1 persons or 1.4 males and 2.7 females respectively. Table 3.1.1 below shows the distributions of all 8, 497 women in the study by sub-district and age category as were recorded at the end of 2009.

**Table 3.1.1: Distribution of all women in the study by district and age category (N=8, 497)**

Sub-district	Number of households	Age category	Number of women	Percentage of women
1	383	15 to 24	818	36.62%
		25 to 34	1298	58.10%
		35 to 49	118	5.28%
Sub-total for sub-district 1			2, 234	100.00%
2	594	15 to 24	826	33.50%
		25 to 34	1423	57.70%
		35 to 49	217	8.80%
Sub-total for sub-district 2			2, 466	100.00%
3	607	15 to 24	483	24.90%
		25 to 34	1250	64.43%
		35 to 49	207	10.67%
Sub-total for sub-district 3			1, 940	100.00%
4	448	15 to 24	663	35.70%
		25 to 34	1213	65.32%
		35 to 49	181	9.75%
Sub-total for sub-district 4			1, 857	100.00%
Total	2, 075		8, 497	

Table 3.1.2 shows the general socioeconomic and demographic characteristics of women in the study who use at least one modern family planning method (**FP users**) as were recorded at the end of 2009. The sample size per health sub-district is equal.

**Table 3.1.2: Characteristics of women utilizing family planning methods (N=3, 547)**

Characteristics of FP users	Number of FP users	Proportion
<b>Type of modern contraceptive used</b>		
Injections	1916	54.03%
Pills	695	19.60%
Condoms	550	15.51%
IUD	291	8.20%
Sterilization	84	2.37%
Vaginal foam	11	0.28%
<b>Age category of FP users</b>		
15 to 24 years	1218	34.34%
25 to 34 years	1427	40.23%
35 to 49 years	902	25.43%
Mean age of FP users = 29.6 years		
Median age of FP users = 29.4 years		
Prevalence of teenage pregnancy = 9.5%		
Prevalence of adverse outcomes of pregnancy = 12.19%		
<b>Marital status of FP users</b>		
Married	1455	41.0%
Living together	1252	35.3%
Divorced	156	4.4%
Separated	177	5.0%
Widowed	99	2.8%
Never married	408	11.5%
<b>Level of education of FP users</b>		
No education	69	1.9%
Primary education	924	26.1%
Secondary education	2249	63.4%
Post-secondary education	305	8.6%
<b>Regular use of FP services</b>		
Yes	3413	96.22%
No	134	3.78%
<b>Health sub-district of FP users</b>		
District 1	886	24.9%
District 2	887	25.0%
District 3	887	25.0%
District 4	887	25.0%
<b>Employment status of FP users</b>		
Enrolled students	983	27.7%
Employed	939	26.5%
Not employed	1625	45.8%

Number of children living with FP users		
0	696	19.6%
1	521	14.7%
2	858	24.2%
3	915	25.8%
4	412	11.6%
5 or more	145	4.1%
Average monthly income in Rand		
Less than 1, 200 Rand	784	22.1%
Between 1, 201 and 6, 000 Rand	1827	51.5%
Between 6, 001 and 12, 000 Rand	504	14.2%
Between 12, 001 and 20, 000 Rand	280	7.9%
Greater than 20, 000 Rand	152	4.3%

It can be seen from Table 3.1.2 that the vast majority of FP users are regular users (96.22%). The mean and median ages of the 3, 547 women who utilized at least one modern family planning method (FP users) were 29 and 28 years respectively. About 34% of women using FP methods were younger than 25 years old, 40% of them were in the 25-34 age category, and the remaining 25% were under the 35-49 age category. Women who were never married represented about 42% of women utilizing modern family planning methods (FP users). Widowed women accounted for about 3% of FP users. About 2% of the 3, 547 women had no formal education, whereas 63% had secondary level education, and 9% had post-secondary level education. Enrolled students accounted for 28% of women utilizing modern family planning methods. Women who were not employed accounted for almost 46% of women utilizing modern family planning methods. Fifty three percent of women had two or more children who lived with them, whereas 21% had no child living with them.

Table 3.1.3 shows that as many as 20.22% of modern contraceptives and family planning services in and around Pretoria are provided by public clinics. The next popular service providers are public hospitals (14.04%), followed by surgeries (12.92%) and pharmacies (11.24%). Faith-based institutions account for only 2.81% of services.



**Table 3.1.3: Types of family planning facilities rendering services in and around Pretoria City**

Type of FP facility	Percentage
Public clinic	20.22
Public hospital	14.04
Surgery	12.92
Pharmacy	11.24
Private hospital	8.99
Educational facilities	7.87
Public facilities	6.74
NGO	6.18
Private clinic	5.06
Midwife	3.93
Faith-based, etc	2.81
Total (3, 547)	100%

Figure 3.1.1 provides the distribution of FP users by age category and district. It can be seen from the figure that roughly 25% of FP users in Districts 1 and 4 are aged 25 to 29 years. In all four districts, the percentage of FP users is low among women aged 45 to 49 years.

**Figure 3.1.1: Distribution of FP users by age category and district**

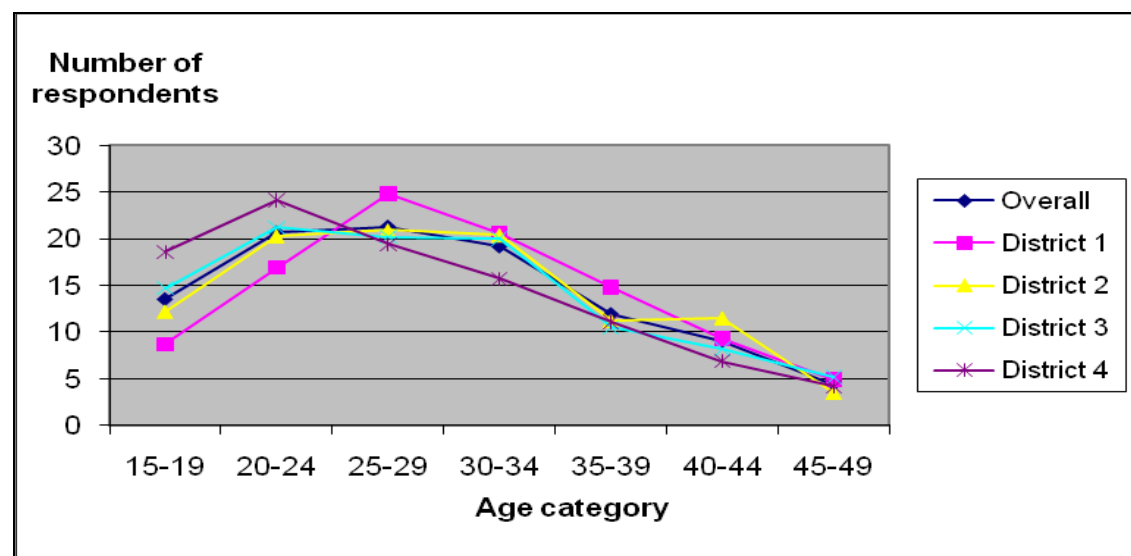


Table 3.1.4 shows that most employed FP users are aged 30 to 34 years (27.4%). The age category 45 to 49 represents the smallest percentage of FP users who have jobs (6.5%).

**Table 3.1.4: Age categories of FP users with jobs**

Age category	Percentage
15 – 19	0.4
20 – 24	9.8
25 – 29	25.8
30 – 34	27.4
35 – 39	18.0
40 – 44	12.1
45 – 49	6.5
Total	100.0%

The total number of FP users with jobs is 940 out of 3, 547 (26.5%). The corresponding percentage for nonusers is 16.8%. This shows that the percentage of employed women is higher in FP users (26.5%) than in nonusers (16.8%).

Figure 3.1.2 shows a graphical depiction of the information provided above in Table 3.14.

**Figure 3.1.2: Age categories of FP users with jobs**

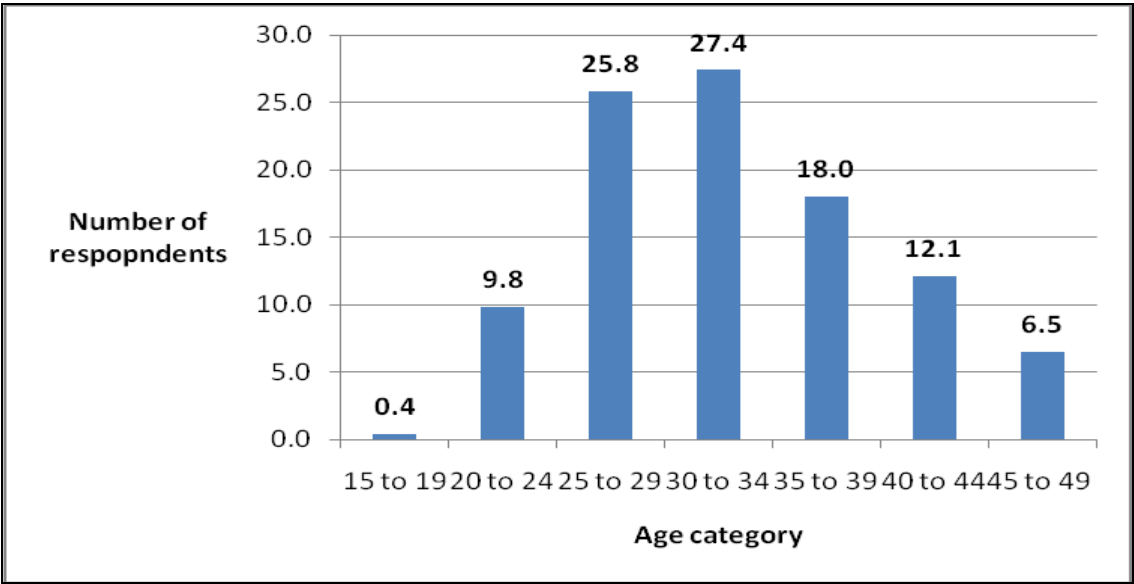


Table 3.1.5 shows that Districts 2 and 3 are the top two districts with 62% and 56% of FP users respectively. District 1 is in third position with 50%. District 4 has the smallest percentage of FP users in Pretoria (35%). District 4 is accounts for black women who are relatively poorly educated, have low income, and live in the Mamelodi suburb of Pretoria City.

**Table 3.1.5: Modern contraceptive use by district**

District	Percentage
1	50
2	62 (mostly whites)
3	56
4	35 (mostly blacks)

Figure 3.1.3 shows a graphical depiction of the information provided in Table 3.1.5 above.

**Figure 3.1.3: Modern contraceptive use by district**

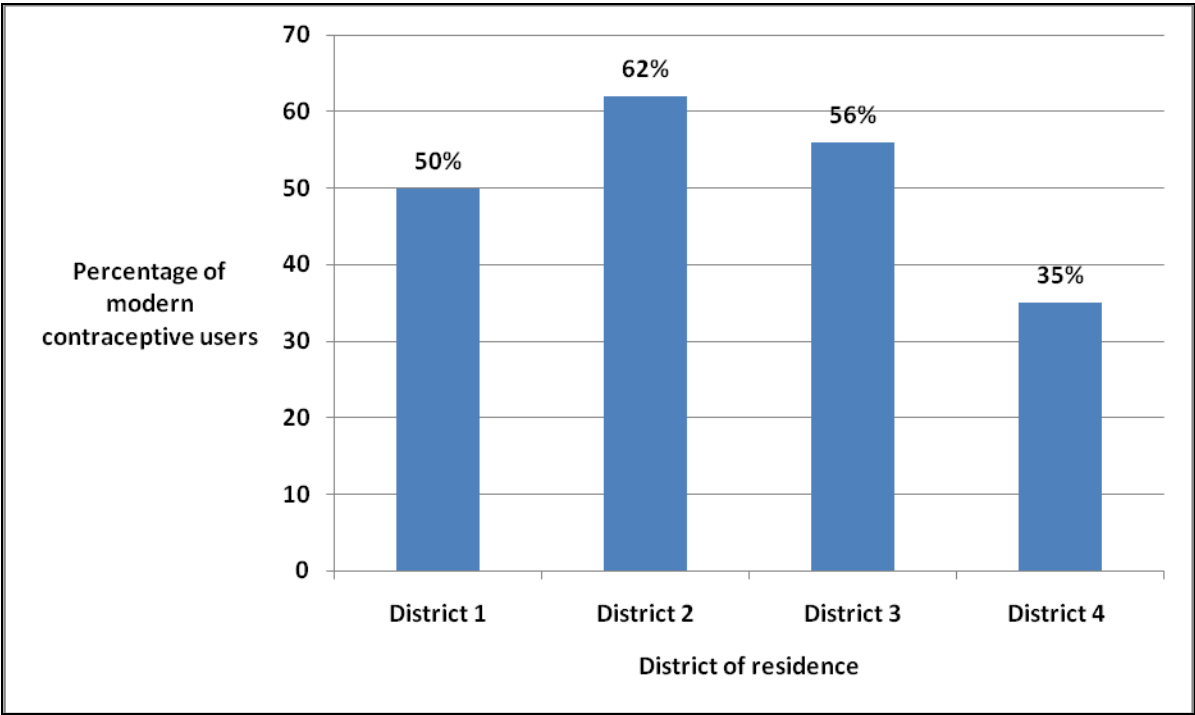


Table 3.1.6 shows that 41% of FP users are married. It can be seen from the table that 35.3% of FP users live together with their sexual partners.

**Table 3.1.6: Marital status of FP users**

Marital status	Percentage
Married	41.0
Never married	11.5
Living together	35.3
Separated	5.0
Divorced	4.4
Widowed	2.8
Total (3, 547)	100%

Figure 3.1.4 shows a graphical depiction of the results displayed in Table 3.1.6 above.

**Figure 3.1.4: Distribution of FP users by marital status**

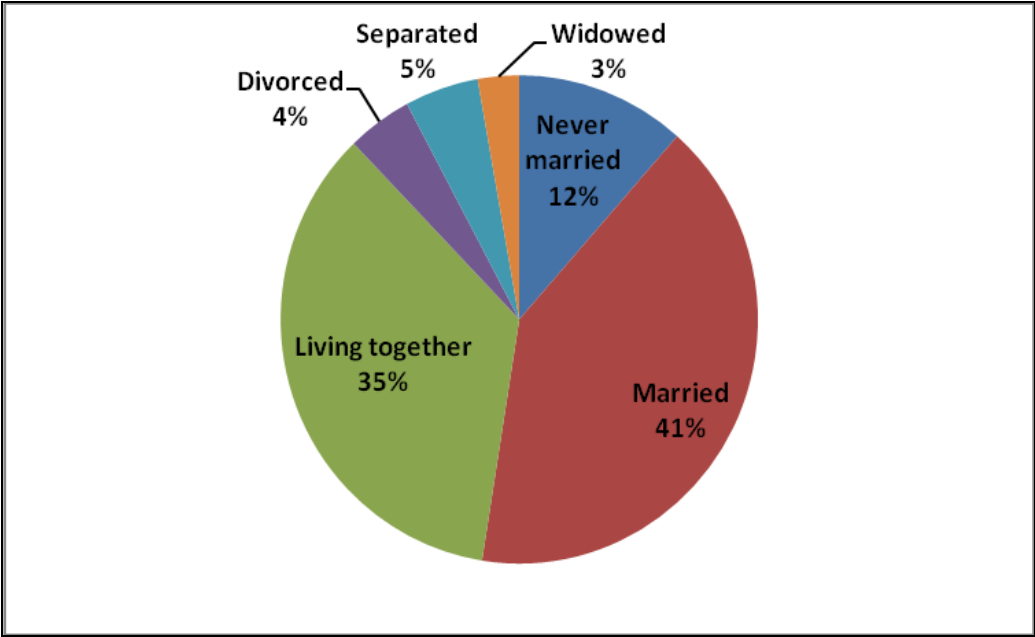


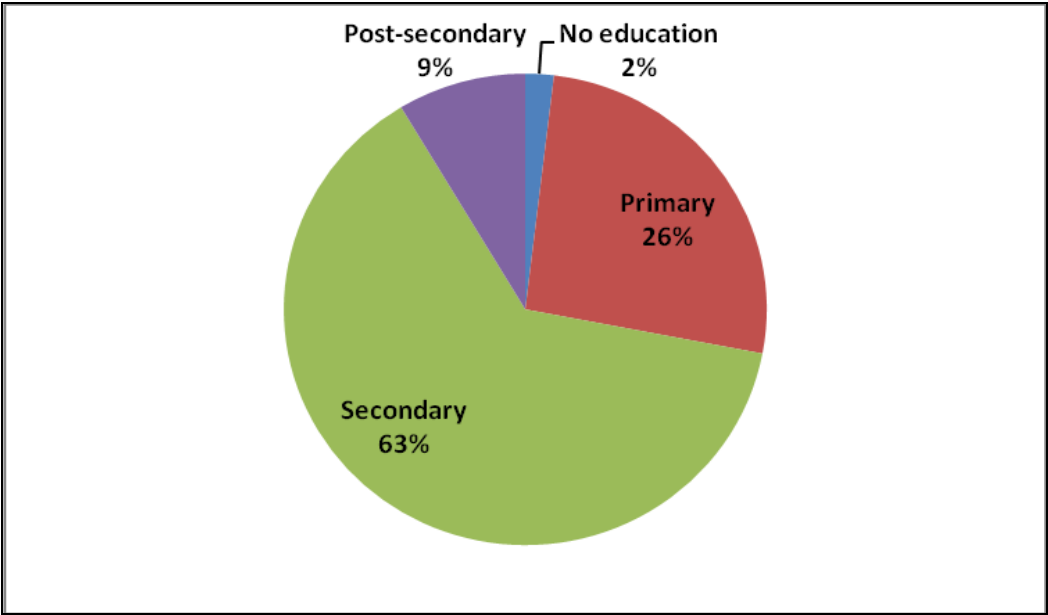
Table 3.1.7 shows that 63.4% of FP users had secondary level education. The percentage of FP users with no formal education was only 1.9%. The percentage of FP users with primary level education was 26.1%.

**Table 3.1.7: Level of education of FP users**

Level of education	Percentage
No education	1.9
Primary	26.1
Secondary	63.4
Post secondary	8.6
Total (3, 547)	100%

Figure 3.1.5 shows a graphical depiction of the information provided in Table 3.1.7 above.

**Figure 3.1.5: Distribution of FP users by level of education**



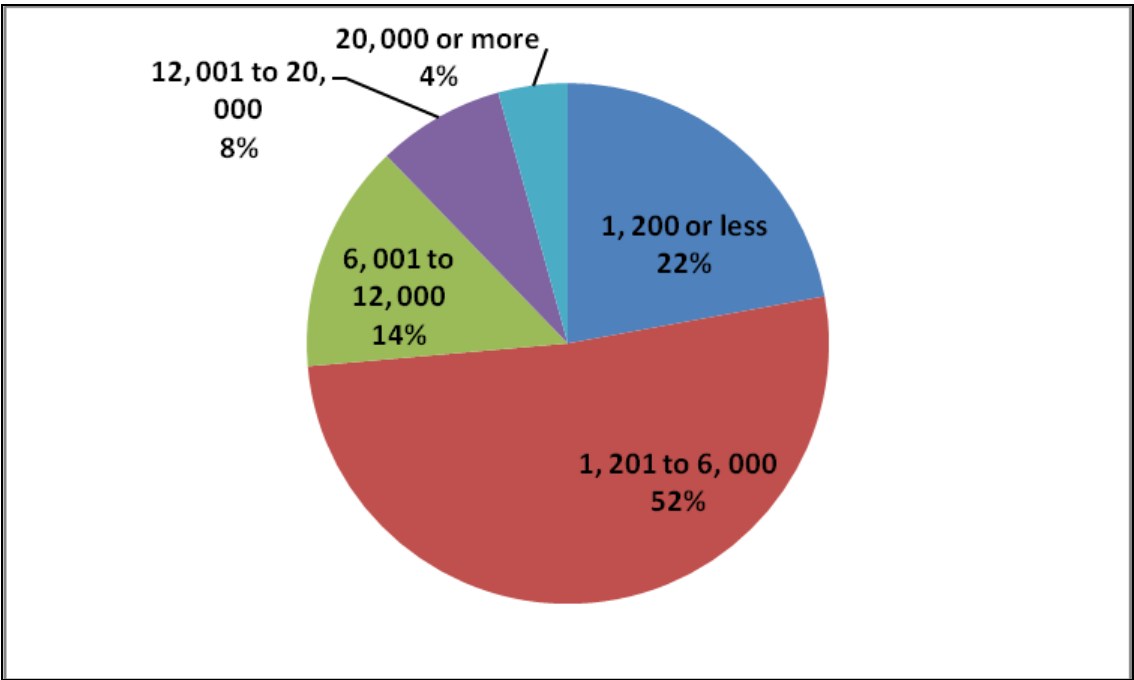
It can be seen from Table 3.1.8 that 22.1% of all FP users live below the poverty level, and that 51.5% of users earn an average income of 6, 000 Rand or less per month. The percentage of women earning more than 20, 000 Rand per month is only 4.3%. According to the World Bank (2010), the income distribution of women in this study is fairly similar to those obtained from developing nations in Latin America (Mexico, Brazil and Chile).

**Table 3.1.8: Average monthly income of FP users**

Average monthly income in Rand	Percentage
Less than 1, 200 Rand	22.1
Between 1, 201 and 6, 000 Rand	51.5
Between 6, 001 and 12, 000 Rand	14.2
Between 12, 001 and 20, 000 Rand	7.9
Greater than 20, 000 Rand	4.3
Total	100.0%

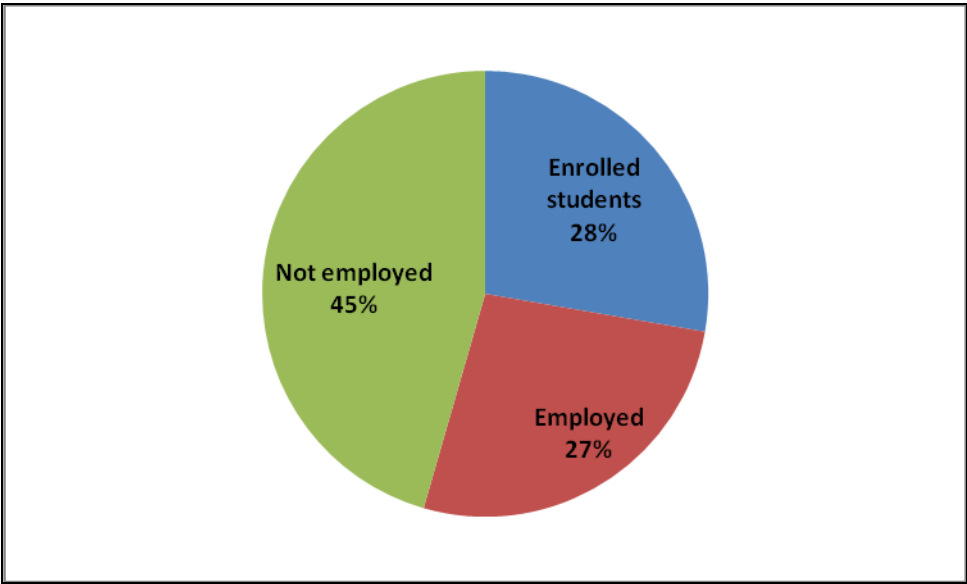
Figure 3.1.6 shows a graphical depiction of the results shown above.

**Figure 3.1.6: Income distribution of FP users**



It can be seen from Figure 3.1.7 that 45% of all FP users are not employed. The percentage of FP users who are employed is 27% only. The rest (28% of FP users) are students who are enrolled at various academic institutions. Studies conducted by the United Nations Populations Fund (2009) in the world’s developing nations have shown that unemployed women cannot afford contraceptive services because they cannot always rely on financial support from their sexual partners. This assessment is similar to the report by the World Bank (2010).

**Figure 3.1.7: Employment status of FP users**



The average number of children living with their mother among FP users is 1.3. The corresponding figure for nonusers is equal to 1.1. This shows that FP users live with more children in comparison with nonusers. Table 3.1.9 shows that as many as 25.8% of FP users live with 3 children. The table also shows that 24.2% of FP users live with 2 children.

**Table 3.1.9: Number of children living with FP users**

Number of children	Percentage
0	19.6
1	14.7
2	24.2
3	25.8
4	11.6
5+	4.1
Total (3, 547)	100%



Figure 3.1.8 shows a graphical depiction of the information provided in Table 3.1.9 above.

**Figure 3.1.8: Number of children of FP users**

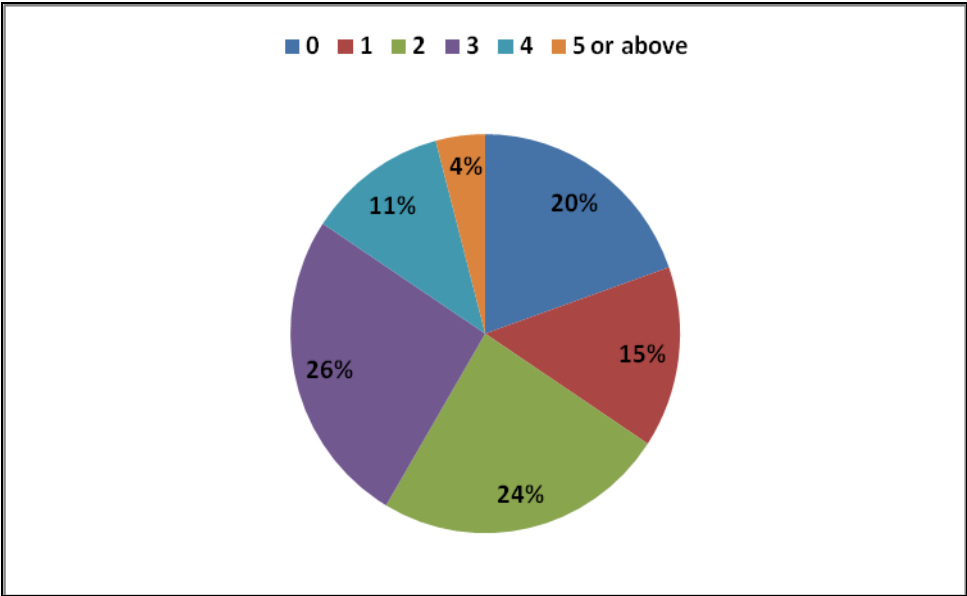


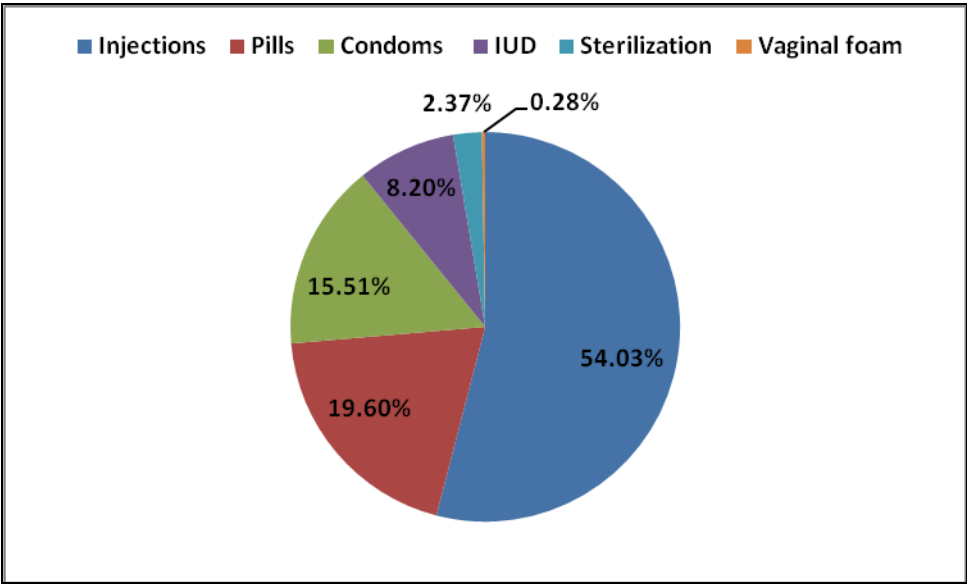
Table 3.1.10 shows the distribution of FP users by choice of contraceptives. The top three most popular choices of contraceptives are injections (54.03%), pills (19.60%), and condoms (15.51%). The least popular method is the use of vaginal foams (0.28%). Intra-uterine devices (IUDs) account for 8.20%, and female and male sterilizations account for 2.37%.

**Table 3.1.10: Distribution of modern FP methods**

Method	Percentage
Injections	54.03
Pills	19.60
Condoms	15.51
IUD	8.20
Sterilization	2.37
Vaginal foam	0.28
Total (3, 547)	100%

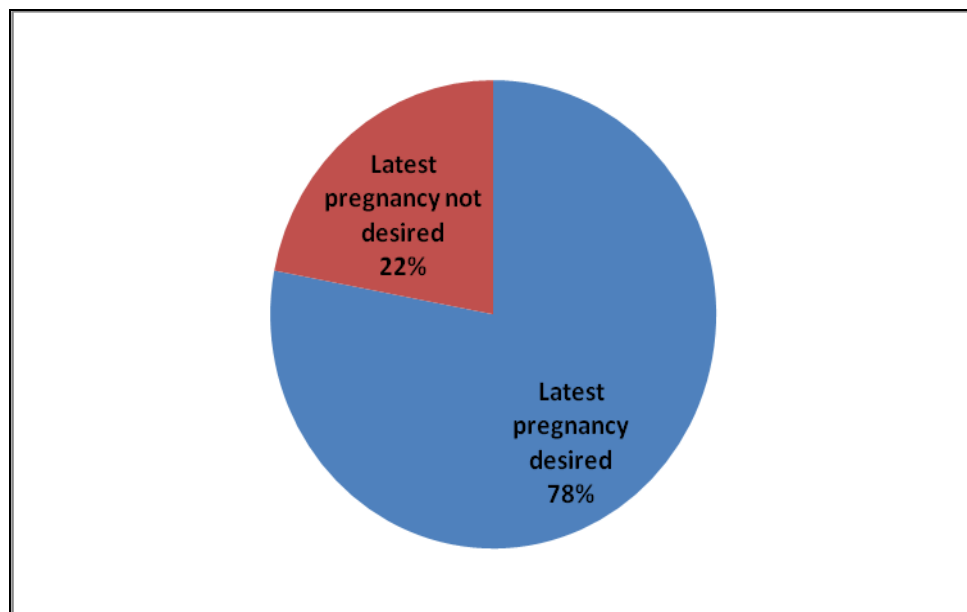
Some of the 4, 950 Respondents who do not use modern family planning methods have used traditional methods such as withdrawal (1.7%) and periodic abstinence (0.12%). The 3, 547 respondents who used at least one modern contraceptive method were asked if they were satisfied with their current method, and 86.5% of them stated that they were satisfied with their method of choice. Roughly 7% of them stated that they were planning to switch to another method of choice. None of the 3, 547 FP users in the study showed interest in traditional methods such as withdrawal and periodic abstinence.

**Figure 3.1.9: Distribution of FP methods**



Sixty six percent of women in the 35-49 age category used at least one modern family planning method. Fifty nine percent of women in the 25-34 age category used at least one modern family planning method. Fifty four percent of women in the 15-24 age category used at least one modern family planning method. Seventy two percent of women with some formal education used at least one modern family planning method.

**Figure 3.1.10: Desire for latest pregnancy among FP users**



The desire for pregnancy is a key indicator of quality of life according to the Union for African Population Studies (2010) and the United Nations Children’s Fund (2009). In this study, 22% of pregnancies were not desired by the mother. Such pregnancies could have been better planned if the mother were adequately empowered. This clearly shows that there is a need for counselling and health education services.

**Table 3.1.11: Ideal age for having first child**

Ideal age for having first child	Percentage of respondents
14	3.5%
15	4.2%
16	5.4%
17	8.0%
18	8.6%
19	11.5%
20	13.9%
21	20.6%
22	5.7%
23	8.0%
24	4.1%
25	6.0%
26	0.5%
<b>Total</b>	<b>100.0%</b>

Table 3.1.11 shows that 20.6% of the 3, 547 FP users in the study believe that the ideal age for having a first child is 21 years. The average age at first birth for FP users was 20.36 years, a figure which is fairly close to the desired age of 21 years.

**Figure 3.1.11: Ideal age for having first child**

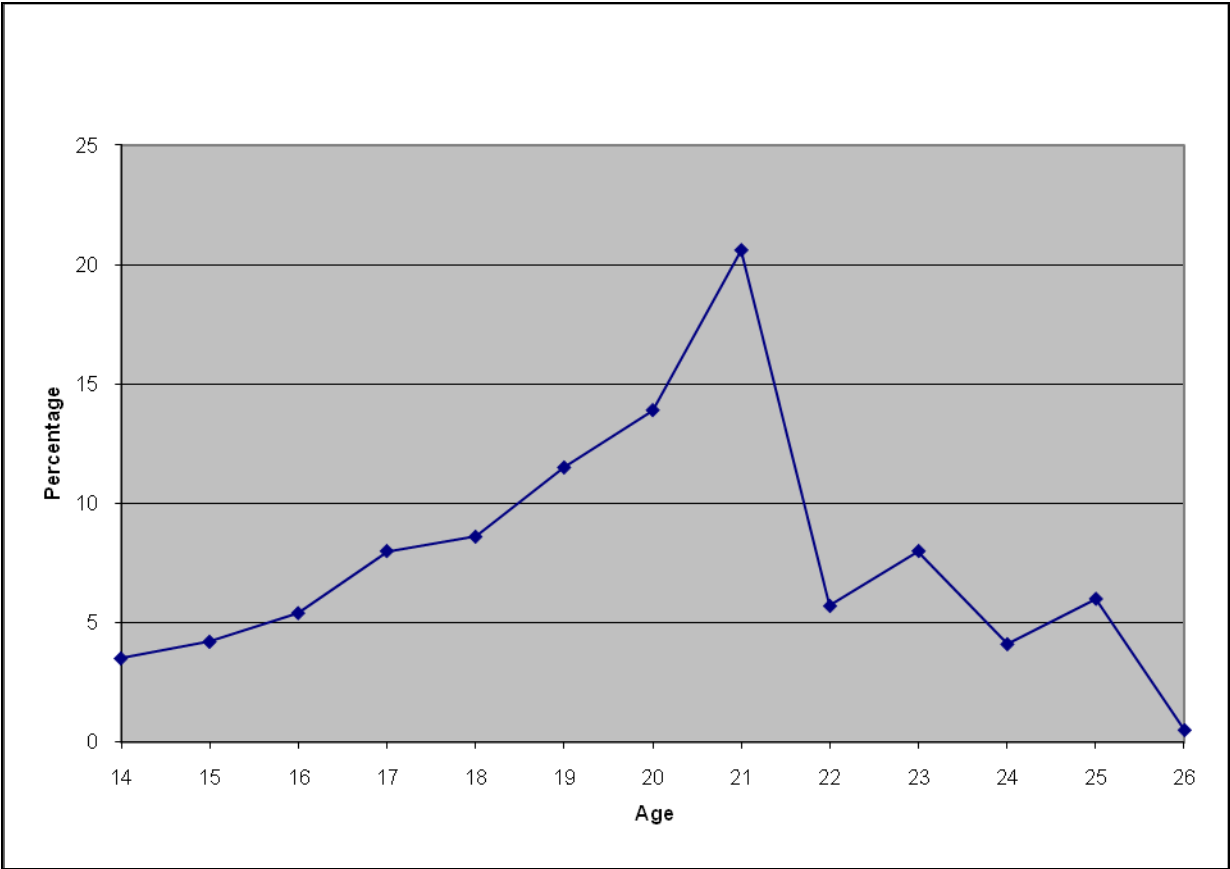


Figure 3.1.11 shows a graphical depiction of the information provided in Table 3.1.11 above.

Early childbirth is often harmful for the mother. Particular victims are teenagers who are not adequately prepared for the challenge of growing up infants (United Nations Children’s Fund, 2007). A recent annual report of the UNAIDS (2009) states that the perception of the mother on early motherhood and childbirth depends on the degree of support provided to her by her immediate family as well as the quality of services provided by institutions that provide family planning services. Figure 3.1.12 shows that as many as 65% of FP users think that early childbirth is harmful for them.

**Figure 3.1.12: Perceived consequences of early child birth**

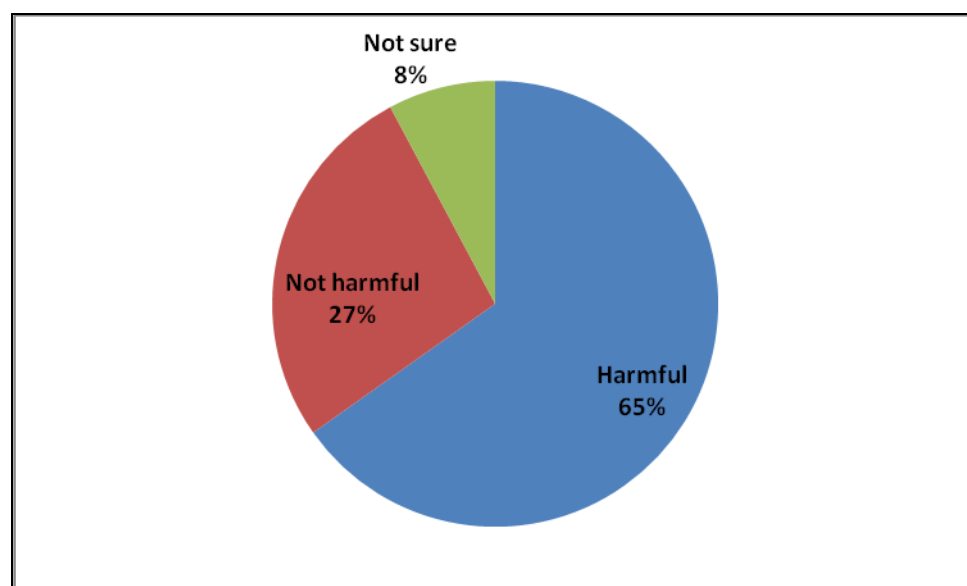


Table 3.1.12 shows that 27.38% of all FP users received their first information on contraceptives from nurses. The second primary sources of information were doctors (17%). The third important sources of information were mothers (16.94%).

**Table 3.1.12: First source of information on contraceptives**

First source of information	Number of women	Percentage of women
Mother	601	16.94
Sister	202	5.69
Father	10	0.28
Relatives	103	2.90
Friends	482	13.59
Teachers	527	14.86
Nurses	971	27.38
Doctors	603	17.00
Magazines	15	0.42
TV or radio	33	0.93
<b>Total</b>	<b>3, 547</b>	<b>100.00</b>

Figure 3.1.13 provides a graphical depiction of the information displayed in Table 8 above.

**Figure 3.1.13: First source of information on contraceptives**

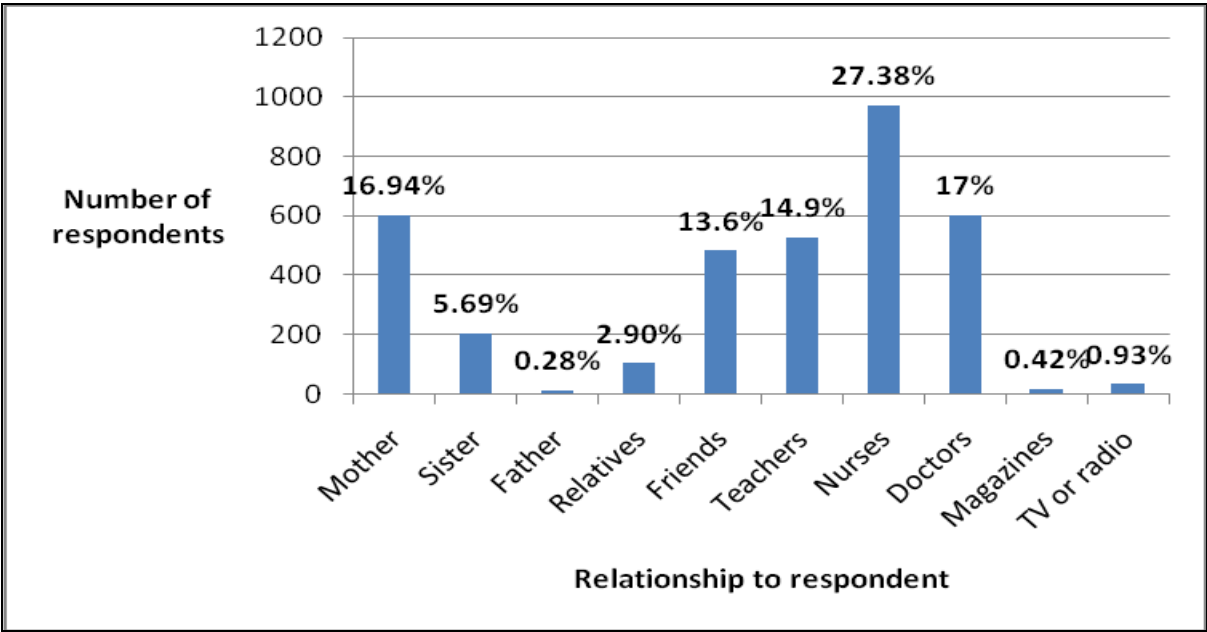


Figure 3.1.14, below, shows the distribution of first source of information on contraceptives by age category of respondents. The table shows that teachers are the principal source of information on contraceptives for teenagers (15 to 19 years of age). In most other groups, nurses are the primary sources of first information on contraceptives.

Figure 3.1.14: Distribution of first source of information on contraceptives by age category

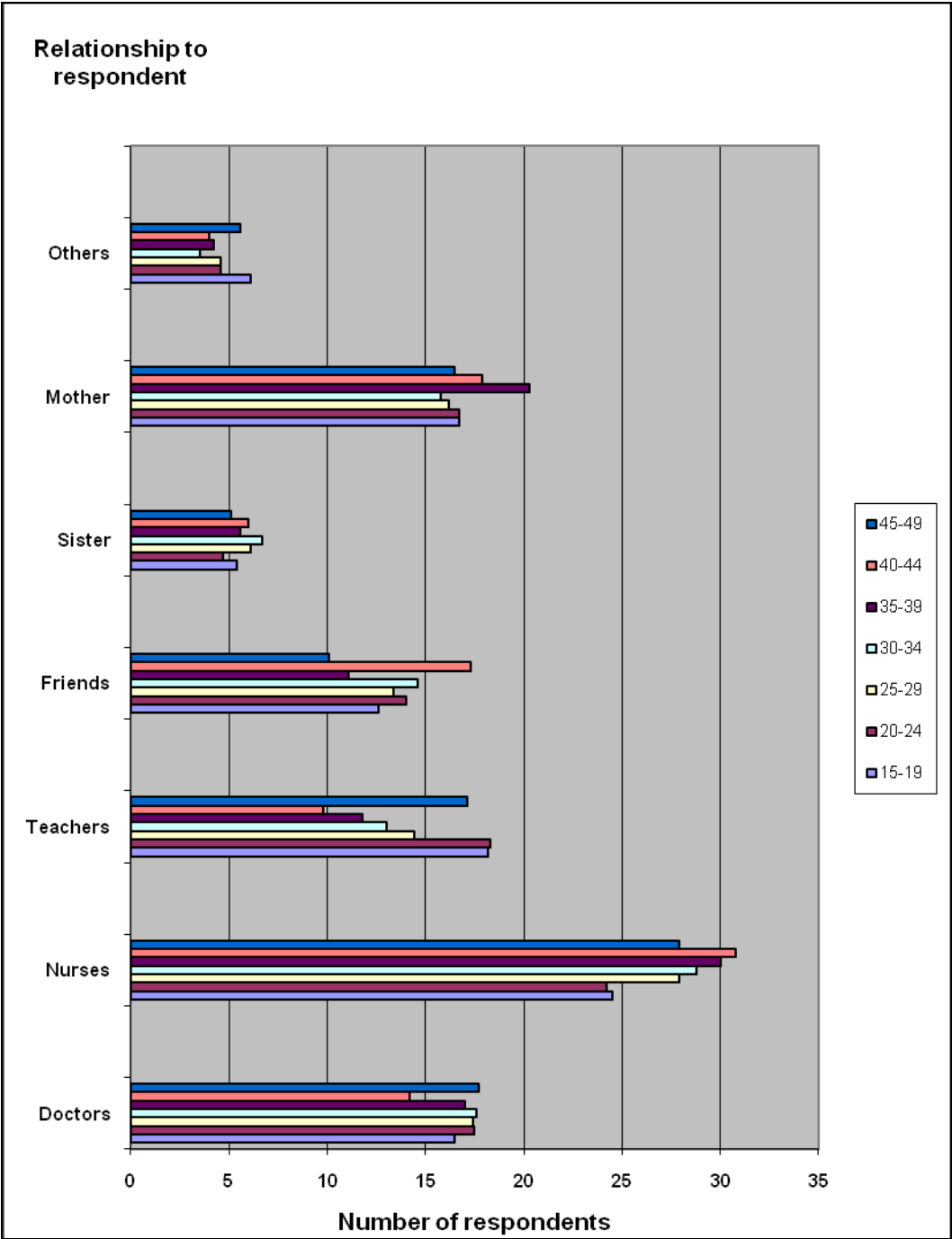


Figure 3.1.15, below, shows the distribution of first source of information on contraceptives by level of education. The table shows that nurses and doctors are the principal sources of information on contraceptives among the least educated women. This finding is in agreement with what has been reported by Moskowitz and

Jennings (2005). According to the United Nations Development Programme (2009), the efficient and systematic dissemination of vital information on reproductive health, family planning methods and modern contraceptives should be made an essential element of macroeconomic planning in all Sub-Saharan African countries.

**Figure 3.1.15: Distribution of source of information on contraceptives by level of education**

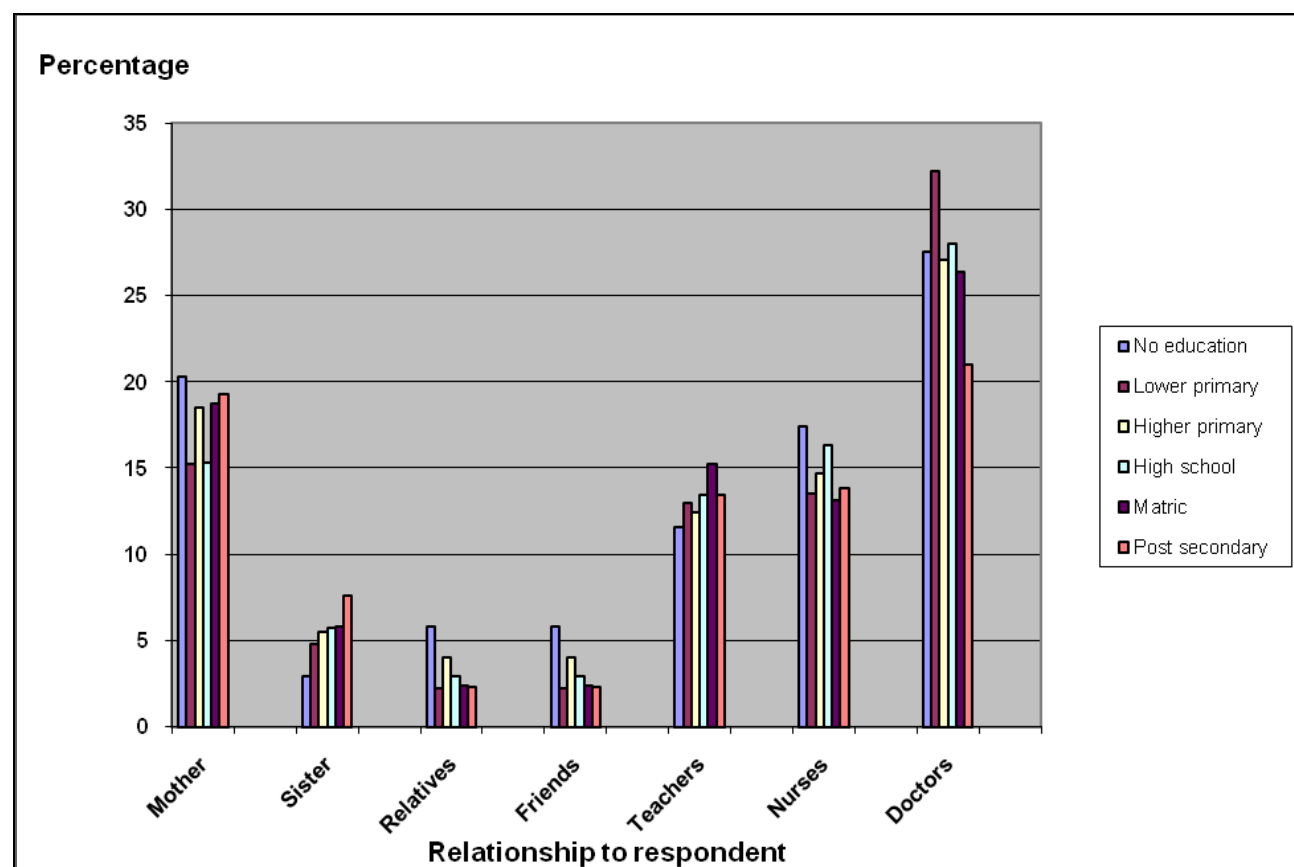


Table 3.1.13 provides the reasons cited by nonusers of FP methods for not utilizing modern family planning methods such as contraceptives.



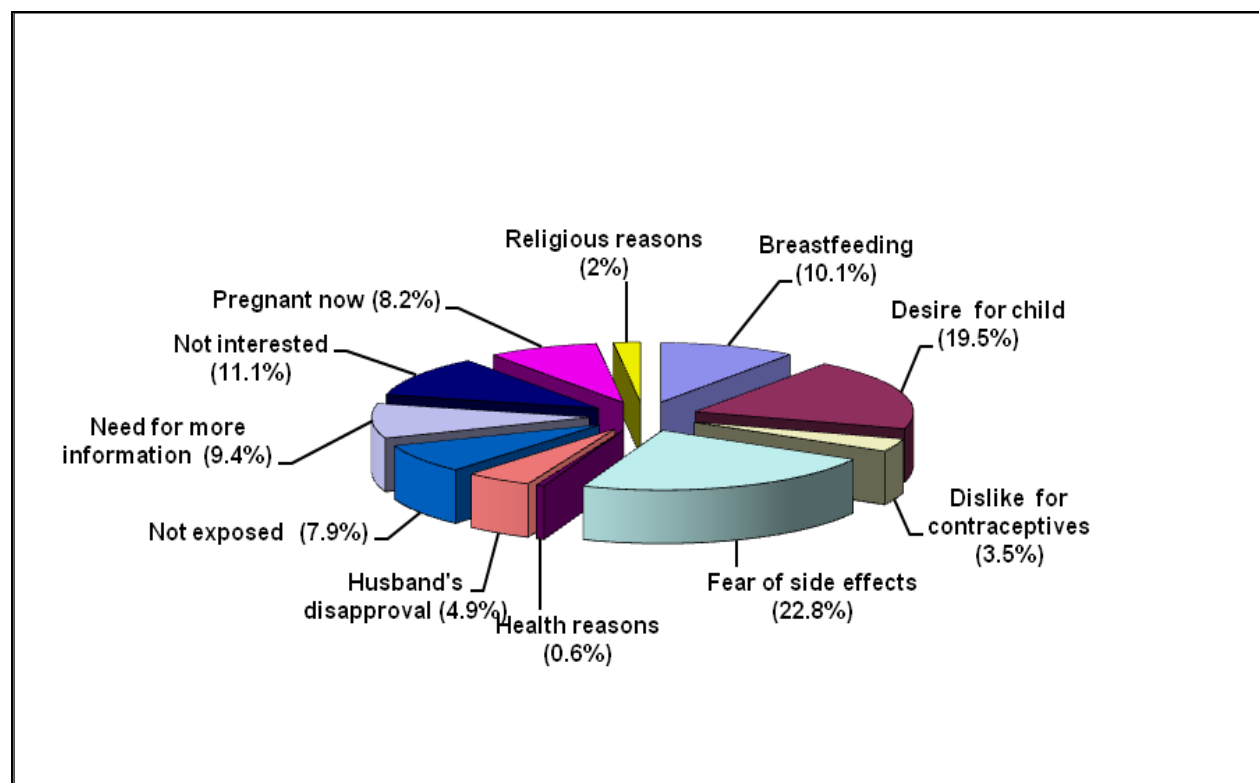
**Table 3.1.13: Reasons provided for not using contraceptives by nonusers (N=4, 950)**

<b>Reasons provided for not using contraceptives by nonusers</b>	<b>Percentage of nonusers</b>
Breastfeeding	10.1
Desire for child	19.5
Dislike for contraceptives	3.5
Fear of side effects	22.8
Health reasons	0.6
Husband's disapproval	4.9
Not exposed to contraceptives	7.9
Need for more information	9.4
Not interested	11.1
Pregnant now	8.2
Religious reasons	2.0
Total	100.0%

As many as 22.8% of the 4, 950 nonusers of contraceptives in the study preferred not to utilize contraceptives due to fear of side effects. Desire for children has been cited by 19.5% of nonusers as a reason for not using contraceptives. Nearly 5% of husbands of nonusers disapprove of contraceptives at the household level. Almost 10% of all nonusers do so due to lack of information on the benefits of contraceptives. This shows that there is a dire need for health education on the benefits of modern contraceptives. According to the United Nations Millennium Development Goals (2007), the provision of health education on family planning services and contraceptives should be actively promoted so that sexually active boys and girls get to know about the choices they could make. This could be done efficiently by providing integrated services that are linked to the school curriculum. Mortality and morbidity figures (Statistics South Africa, 2007) that are attributed to lack of proper health education on family planning methods indicate that the provision of health education to teenagers based on community based methods is strategically beneficial for reducing mortality among teenagers (South African Health Systems Trust, 2009).

Figure 3.1.16 below provides a graphical depiction of the information provided in Table 3.1.13.

**Figure 3.1.16: Reasons provided for not using contraceptives by nonusers (N=4, 950)**



The percentage of nonusers who do not use contraceptives due to religious reasons is only 2%. This clearly shows that religion did not play a prominent role in discouraging nonusers from using modern family planning methods and contraceptives. FP users and nonusers combined, the percentage of Christians (including Catholics, Anglicans, Protestants, Pentecostal, Adventist, Jehovah Witness, and all other known Christian denominations), Muslims, Hindus, and African traditional religious practitioners was 78.04%, 1.34%, 1.14%, and 0.29% respectively. Non-religious, Jewish, Buddhist and Chinese religious respondents jointly accounted for 19.19% of the 8, 497 respondents. A significant majority of nonusers (82.58%) were aware of family planning services and contraceptive methods, but only 23.45% of them knew that the services were provided by the CTMM.

Figure 3.1.17 shows that condoms are most popular (38.5%) among pupils in Grades 7 to 11. Condoms are also popular among Grade 12 pupils (26.8%). Condoms are not appreciated with people with no formal education. This shows that level of education is significantly and positively associated with the degree of interest shown in the use of condoms. This finding is in agreement with recommendations made by the Health Department of the City of Tshwane Metropolitan Municipality (2010) as well as survey results published by Statistics South Africa

(2003) on the relationship between level of education and utilization of primary health care services provided to the general population in South Africa.

**Figure 3.1.17: Condom use by level of education**

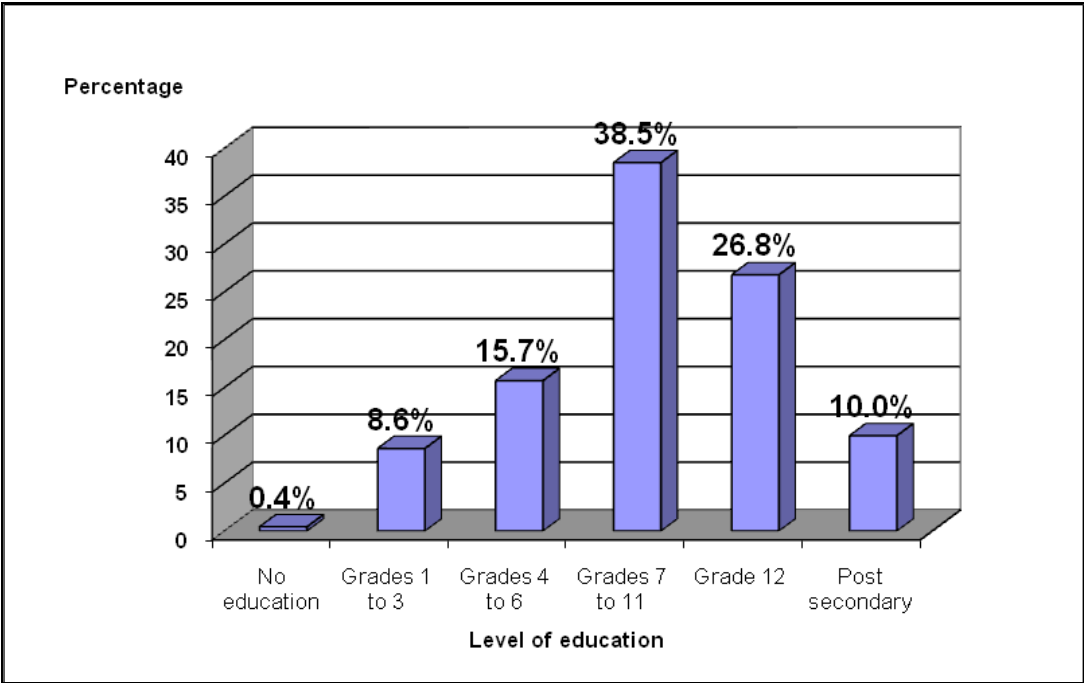


Figure 3.1.18, below, shows the distribution of FP users by district of residence, employment status and category.

**Figure 3.1.18: Employment status of FP users by district and age category**

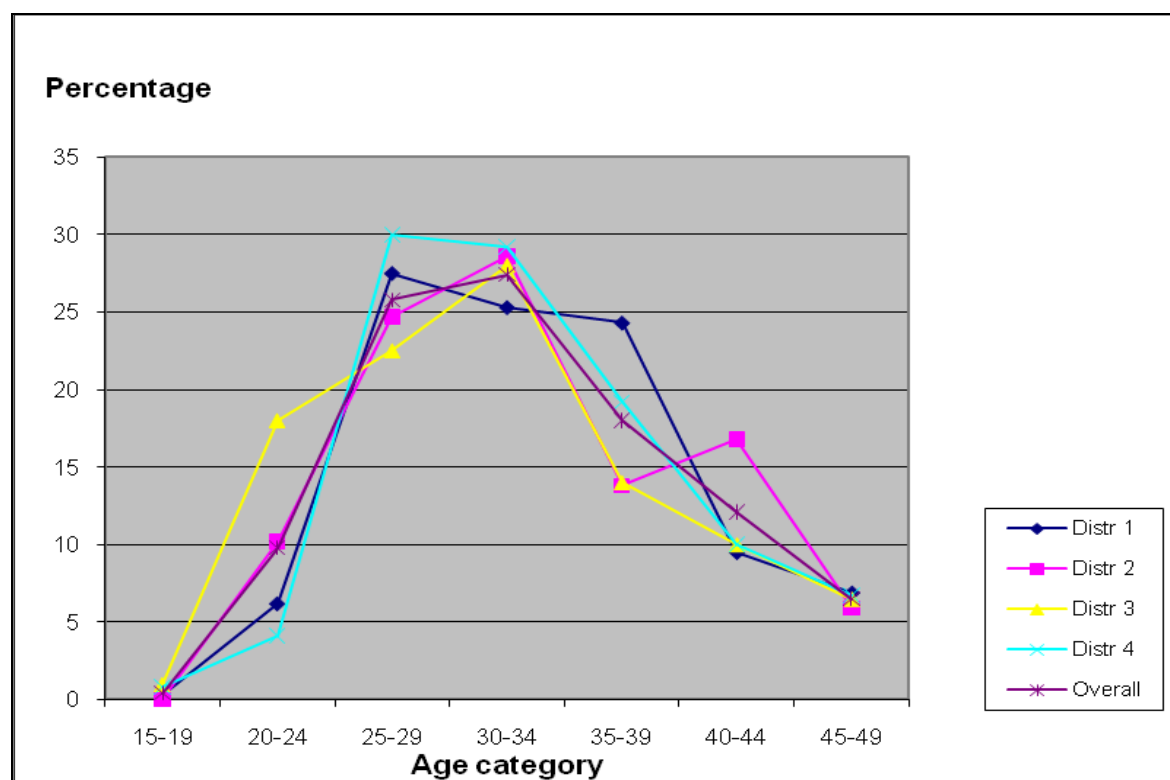


Table 3.1.14 presents a comparison between FP users and nonusers with regards to several socioeconomic, demographic and health-related variables. Users and nonusers of family planning methods were fairly similar with regards to age distribution. However, the two groups were significantly different from each other with regards to key socioeconomic variables such as level of education, family size, income, the prevalence of adverse outcomes of pregnancy, marital status, the number of children living with their mothers, as well as employment status. The table shows that FP users were marginally older than nonusers, and had slightly more children living with them. The mean ages of FP users and nonusers were 29.6 and 29.3 respectively. The median ages of users and non-users were 29.4 and 29.2 respectively. The average number of children living with their mothers for users and nonusers were 1.3 and 1.1 respectively. Users were relatively better educated in comparison with nonusers, and had a relatively better income and smaller family size in comparison with nonusers. More FP users were married in comparison with nonusers. The prevalence of adverse outcomes of pregnancy was significantly higher in nonusers (16.55%) than in users (6.12%).

**Table 3.1.14: Comparison between users and nonusers of contraceptives**

<b>Characteristics</b>	<b>Users (N=3, 547)</b>	<b>Nonusers (N=4, 950)</b>
<b>Age distribution</b>		
15 to 24	1218 (34.34%)	1702 (34.38%)
25 to 34	1427 (40.23%)	1992 (40.24%)
35 to 49	902 (25.43%)	1256 (25.37%)
Mean age	29.6	29.3
Median age	29.4	29.2
Average age at first sex	18.72	19.02
Average age at first pregnancy	19.36	18.74
<b>Level of education</b>		
No education	69 (1.9%)	195 (3.94%)
Primary	924 (26.1%)	2311 (46.69%)
Secondary	2249 (63.4%)	2175 (43.94%)
Post-secondary	305 (8.6%)	269 (5.4%)
<b>Family size</b>		
Less than or equal to 5	79.84%	68.49%
Greater than 5	20.16%	31.51%
Average number of children living with mother	1.3	1.1
<b>Number of children living with mother</b>		
0	19.6%	8.7%
1	14.7%	10.1%
2	24.2%	28.5%
3	25.8%	29.8%
4	11.6%	14.6%
5 or more	4.1%	8.3%
Prevalence of teenage pregnancy	9.5%	10.25%
Prevalence of adverse outcomes of pregnancy	6.12%	16.55%
<b>Average monthly income in Rand</b>		
Less than 1, 200 Rand	22.1%	27.9%
Between 1, 201 and 6, 000 Rand	51.5%	54.4%
Between 6, 001 and 12, 000 Rand	14.2%	9.9%
Between 12, 001 and 20, 000 Rand	7.9%	6.6%
Greater than 20, 000 Rand	4.3%	3.8%
<b>Marital status</b>		
Single or never married	11.5%	18.8%
Married	41.0%	44.9%
Living together	35.3%	26.2%
Separated	5.0%	6.5%
Divorced	4.4%	2.2%
Widowed	2.8%	1.4%
<b>Employment status</b>		

Enrolled students	27.7%	26.4%
Employed	26.5%	16.8%
Not employed	45.8%	56.8%
<b>Sexually transmitted infectious diseases over the past 12 months</b>		
Not infected	90.28%	90.13%
At least once	9.72%	9.87%
<b>Number of sexual partners over the past 12 months</b>		
Only one or none	45.00%	43.97%
Two or more	55.00%	56.03%
<b>Access to tap water at home</b>		
Yes	88.92%	87.11%
No	11.08%	12.89%
<b>Ownership of flush toilet at home</b>		
Yes	57.09%	56.33%
No	42.91%	43.67%
<b>Degree of trust on sexual partner</b>		
No trust at all	4.96%	4.01%
Inadequate trust	8.01%	4.85%
Moderate trust	47.55%	52.01%
Good trust	25.63%	24.68%
Absolute trust	13.85%	14.45%

Table 3.1.14 shows that 41% of FP users and 44.9% of nonusers are married. It can be seen from the table that married women account for the largest percentage of FP users. Women who live together with their sexual partners account for 35.3% of all FP users. The two groups seem to be fairly similar with regards to experiencing sexually transmitted diseases, ownership of flush toilets, access to tap water at home, and level of trust on sexual partners. FP users seem to be slightly better off than nonusers with regards to average monthly income. The comparisons shown in Table 3.1.14 are by and large in agreement with findings from the South African Demographic and Health Survey of 2003 (South African National Department of Health, South African Medical Research Council & ORC MACRO, 2007).

**Figure 3.1.19: Comparison between users and nonusers with regards to pregnancy outcomes**

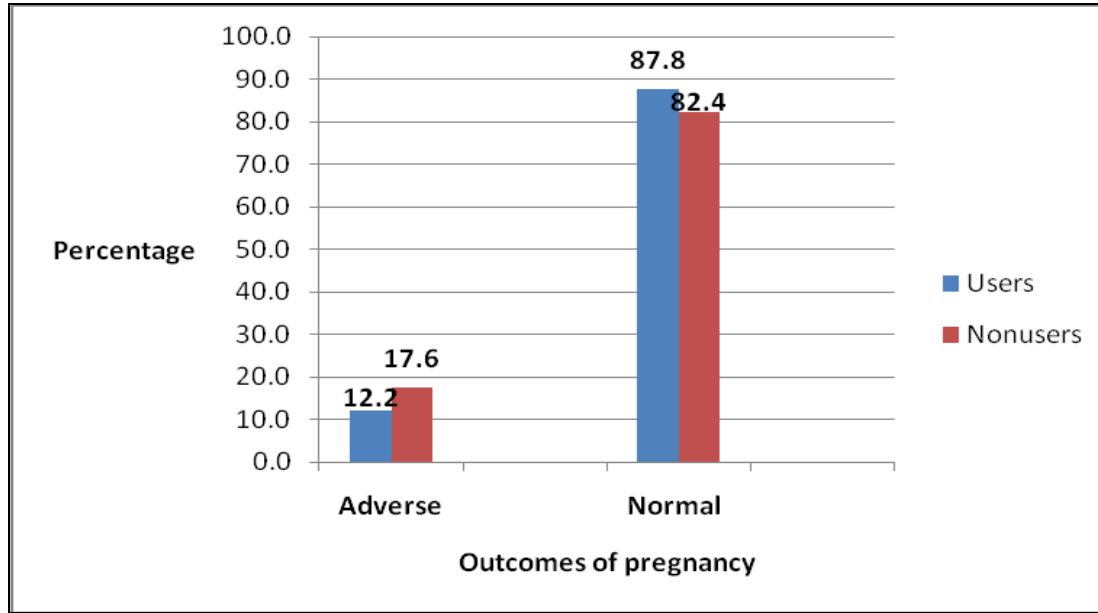


Figure 3.1.19 shows that there is a moderate difference among FP users and nonusers with regards to the number of adverse pregnancy outcomes experienced during the period of study. It can be seen from the figure that FP users have generally done relatively better.

Table 3.1.15 shows that users of FP methods are relatively better educated than nonusers. It can be seen from the table that 46.7% of nonusers only have primary level education, whereas the corresponding figure for FP users is significantly smaller at 26.1%.

**Table 3.1.15: Comparison between users and nonusers with regards to level of education**

Level of education of respondent	FP Users	Nonusers
No education	1.9%	3.9%
Primary level of education	26.1%	46.7%
Secondary level of education	63.4%	43.9%
Post-secondary level of education	8.6%	5.4%

Figure 3.1.20, below, displays a graphical depiction of the information provided in above in Table 3.1.15.

**Figure 3.1.20: Comparison between users and nonusers with regards to level of education**

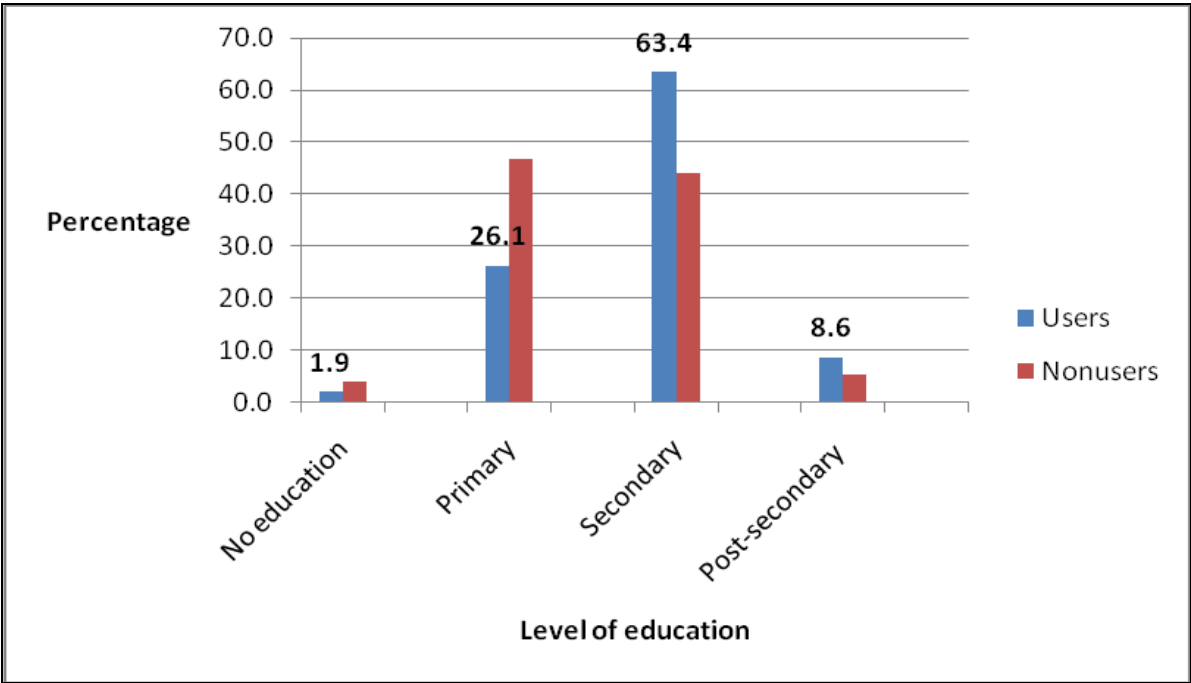


Figure 3.1.21, below, shows a comparison between FP users and nonusers with regards to family size. It can be seen from the figure that FP users have relatively smaller family sizes.



**Figure 3.1.21: Comparison between users and nonusers with regards to family size**

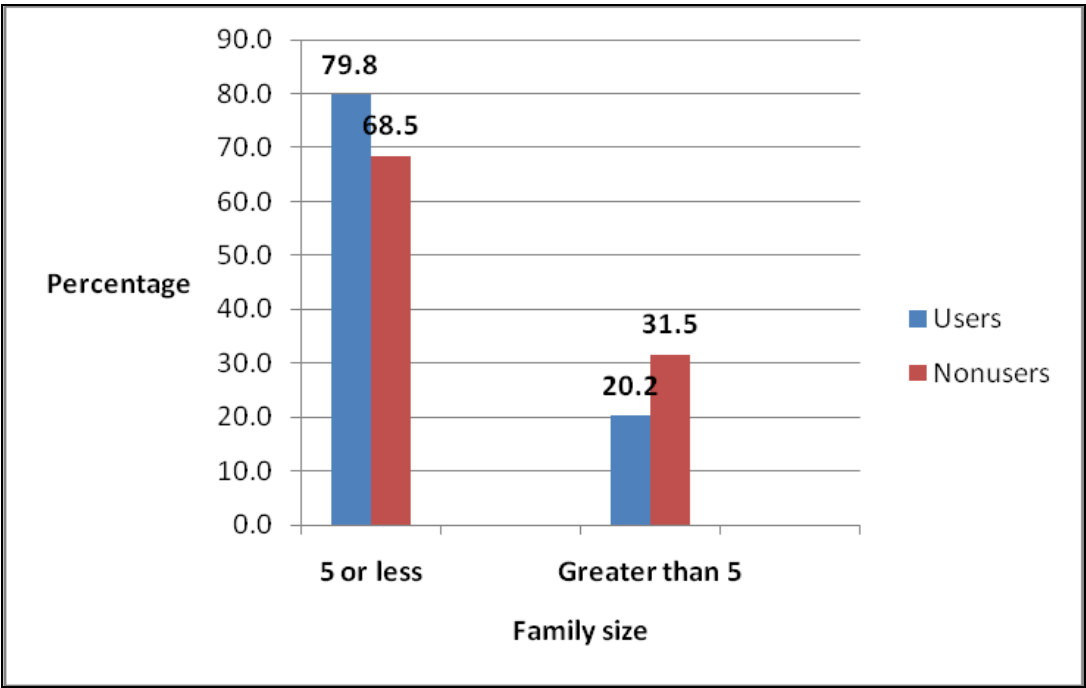


Figure 3.1.22 shows that the average age at first sex for FP users is 18.72 years. The corresponding age for nonusers is 19.02 years. This shows that users feel more encouraged to have sex at an earlier age in comparison with nonusers. This difference is attributed to lack of awareness and misconception about modern family planning methods among poorly educated and unemployed women.

Figure 3.1.22: Average age at first sex for FP users

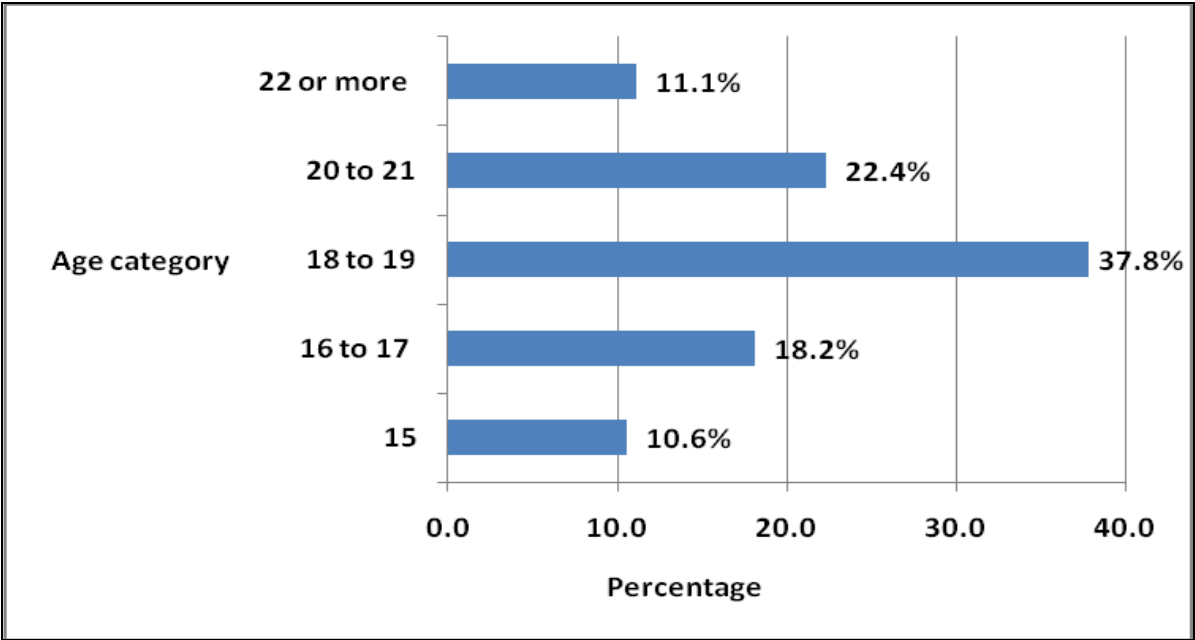


Figure 3.1.23 shows that 44% of relationships between FP users and their sexual partners are based on marital relationships.

**Figure 3.1.23: Type of relationship with sexual partner for FP users**

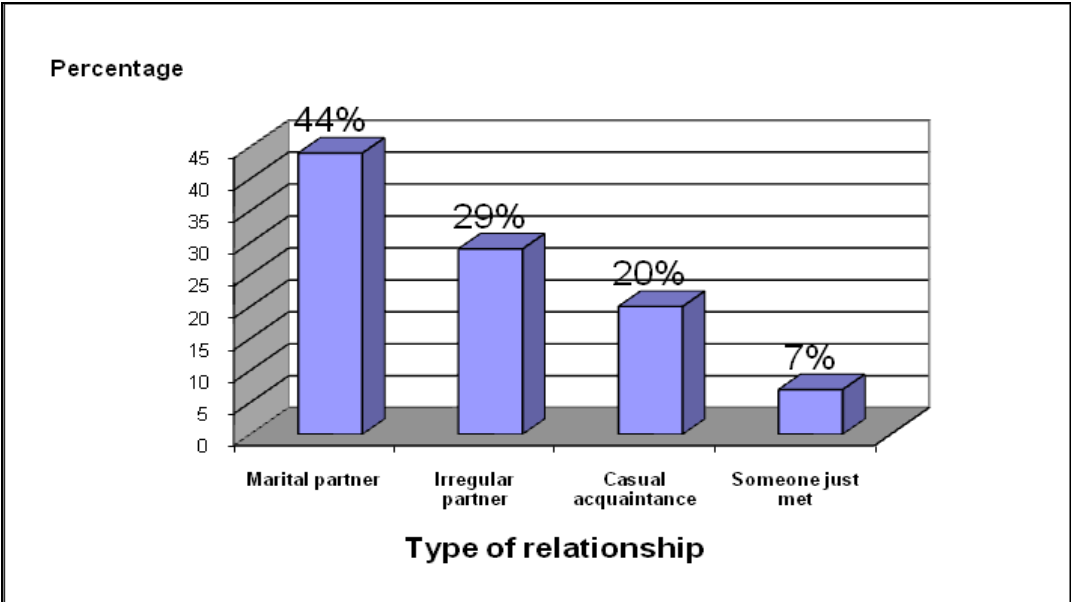


Figure 3.1.24 shows that as many as 30.5% of FP users have seen two sexual partners over the past 12 months. The percentage of FP users who saw only one sexual partner over the past 12 months is 45%. The fact that 55% of all FP users saw two or more sexual partners over the past 12 months indicates that there is a great deal of promiscuity among FP users.

Figure 3.1.24: Average number of sexual partners seen over past 12 months for FP users

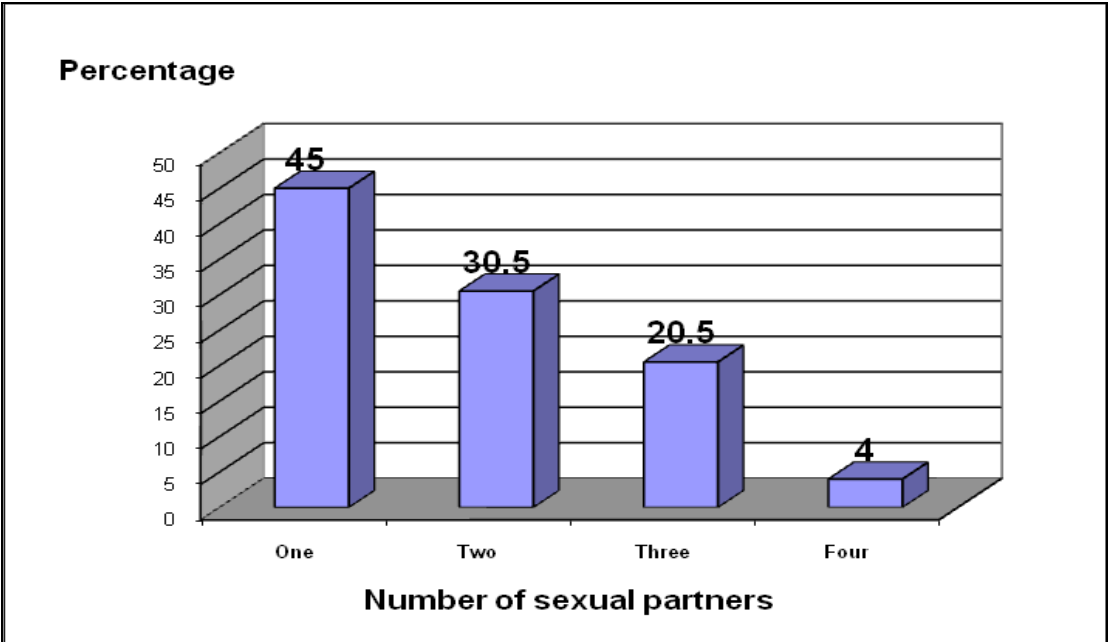


Table 3.1.16 shows the general characteristics of the 3, 547 FP users in the study as a function of five commonly used methods of contraception. The percentage of FP users who utilize vaginal foams is only 0.28%. As such, the vaginal foam method is removed from Table 3.1.16.

**Table 3.1.16: Characteristics of FP users by choice of contraceptive method (Proportions)**

Characteristics	Injections	Pills	Condoms	IUD	Sterilization
<b>Age category</b>					
15-24 years	32.5	21.2	36.6	9.4	0.3
25-34 years	65.1	16.2	11.3	6.2	1.2
35-49 years	48.0	16.3	3.0	8.3	24.4
<b>Level of education</b>					
No education	62.8	13.7	3.9	5.9	13.7
Primary	46.0	18.9	12.5	7.0	15.6
Secondary	55.7	16.6	14.1	7.9	5.7
Post-secondary	51.7	17.6	13.1	7.4	10.2
<b>Marital status</b>					
Married	59.1	21.0	1.3	6.6	12.0
Living together	62.3	11.3	12.1	8.2	6.1
Divorced	57.0	7.0	10.0	6.0	20.0
Separated	42.4	15.2	27.2	4.0	11.2
Widowed	39.3	17.9	7.1	21.4	14.3
Never married	42.4	16.7	29.3	8.9	2.7
<b>District of residence</b>					
District 1	32.4	38.9	17.7	4.9	6.1
District 2	66.4	15.1	7.1	8.5	2.9
District 3	61.6	5.1	11.1	11.1	11.1
District 4	45.9	7.6	21.6	4.0	20.9
<b>Employment status</b>					
Student	31.0	24.8	38.4	5.0	0.8
Employed	54.5	20.5	7.8	8.5	8.7
Not employed	57.7	13.3	10.2	7.6	11.2

It can be seen from Table 3.1.16 that injections are most popular with FP users in the 25-34 year age category. Users of injections have no formal education, live together with their sexual partners, and are predominantly not employed. Injections are most popular with residents in health sub-district number 2.

The use of condoms is lowest (4%) among women with no formal education and it increases to 14% among women with secondary level education. Although injection is the preferred method among all four educational categories, it is also the most preferred method (63%) among women with no formal education. Intra-uterine devices (IUDs) are used by 6% of women with no formal education, 7% of women with primary level education, and 8% of women with secondary level education. Pills are used by 19% of women with primary level education, and are popular among students (24.8%) and residents of sub-district 1 (39%). Sterilization is most popular with women in the age category 35-49 years (24.4%) as well as women who live in sub-district number 4 (21%).

Condoms are most popular among young women in the age category 15 to 24 years (37%). Condoms are also highly popular with single women who have never been married (29.3%) and students (38.4%). Injections are popular among women who live together with their sexual partners (62%) as well as women who are married (59.1%) and divorced (57%). Only 39.3% of widowed women use injections as a means of contraception. The choice of pills is highest among married women (21%) followed by widowed women (18%), women who have never been married (17%) and women who are separated from their sexual partners (15%). The demand for sterilization is the lowest (3%) among women who have never been married.

The choice of condoms is the highest in district 4 (22%) and district 1 (18%). The percentage of women using condoms in district 2 is only 7%. District 2 has the highest preference for injection (66%); district 3 comes second with 62%; and district 1 comes last with 32%. The choice of IUDs is higher (11%) in district 3 than in district 2 (9%), and is lowest in district 4 with only 4%. Pills (39%) and sterilization (21%) are quite popular in districts 1 and 4 respectively.

Most students use condoms (38.4%), injections (31%), and pills (24.8%) as a means of contraception. Women who live together with their sexual partners use injections (62.3%), pills (11.3%), and condoms (12.1%) as their top-three choices of contraception methods.

Table 3.1.17 presents information on the living patterns of the 3, 547 FP users in the study as a function of five commonly used methods of contraception. The percentage of FP users who utilize vaginal foams is only 0.28%. As such, the vaginal foam method is removed from Table 3.1.17.

**Table 3.1.17: Living patterns of FP users by choice of contraceptive method (Proportions)**

Characteristics	Condoms	Injections	IUDs	Pills	Sterilizations
<b>Ever given birth</b>					
No	30.6	40.7	9.4	18.0	1.3
Yes	9.5	55.7	7.1	17.1	10.6
<b>Currently living together with partner</b>					
No	23.3	44.1	7.5	18.2	6.9
Yes	4.6	60.9	7.5	16.3	10.7
<b>Currently having a partner</b>					
No	20.5	50.4	7.8	15.2	6.1
Yes	7.5	55.1	7.3	18.9	11.2
<b>Ever been pregnant</b>					
No	30.7	40.9	9.2	17.9	1.3
Yes	9.6	55.6	7.1	17.1	10.6
<b>Number of living children</b>					
None	32.4	40.5	9.3	17.5	0.3
One child	19.1	57.9	6.3	14.4	2.3
Two or more children	4.0	54.7	7.5	18.6	15.2

The top three preferred methods of contraception among women who currently have a sexual partner are injections (55%), pills (19%) and sterilization (11%). Condoms (20.5%) and injections (50.4%) are also popular with women who do not have sexual partners. The table shows that 55% of women who live with two or more children rely on injections as a means of contraception. A sizeable percentage of women who have given birth to children (40.7%) rely on injections as a means of contraception.

Table 3.1.18 presents information on the source of first information on contraceptives and supply for the 3, 547 FP users in the study as a function of five commonly used methods of contraception. The percentage of FP users who utilize vaginal foams is only 0.28%. As such, the vaginal foam method is removed from Table 3.1.18.

**Table 3.1.18: Source of first information on contraceptives and supply (Proportions)**

Characteristics	Condoms	Injections	IUDs	Pills	Sterilizations
<b>Source of first information on contraceptives</b>					
Mother	11.0	56.8	8.0	18.1	6.1
Sister	10.3	55.7	6.2	18.5	9.3
Relative	17.0	52.8	1.9	11.3	17.0
Friend	15.0	58.0	5.5	12.4	9.1
Teacher	18.9	46.6	11.2	13.4	9.9
Nurse	10.9	54.0	7.3	17.3	10.5
Physician	14.2	46.7	8.0	24.2	6.9
<b>Source of supply</b>					
Public sector	12.4	54.1	6.5	18.4	8.6
Private sector	13.2	51.6	12.5	13.5	9.2
Private pharmacies	23.4	44.4	6.4	13.7	12.1

Table 3.1.18 shows that teachers (19%), relatives (17%), friends (15%) and physicians (14%) are the most preferred sources of first information on condoms, whereas friends (58%), mothers (57%), sisters (56%), nurses (54%) and relatives (53%) are the preferred sources of first information on injections, respectively. The least preferred sources of first information on condoms and injections are sisters (10%), teachers (47%) and physicians (47%), respectively. The most preferred sources of first information on IUDs, pills and sterilizations are teachers (11%), physicians (24%) and relatives (17%). The least preferred sources are relatives (2%) and mothers (6%), respectively.

Private pharmacies (23%) are the main suppliers of condoms, followed by the private health sector (13%). Injections are supplied mostly by both public (54%) and private (52%) health sectors, respectively. IUDs (13%), pills (18%) and sterilizations (12%) are commonly supplied by the private sector, the public sector, as well as private pharmacies in a decreasing order. The provision of IUDs and sterilization services by private pharmacies is based on a special agreement reached between the City of Tshwane Metropolitan Municipality (CTMM) and private pharmacies in 1996. Under this arrangement, pharmacies are supplied with contraceptive methods free of charge, and their nursing staffs are trained on family planning methods and techniques. Such pharmacies are required to provide the CTMM with regular reports on their achievements and needs.



### 3.2: Results from Pearson's chi-square tests of associations

The Pearson chi-square test of association (Dawson and Trapp, 2004) was used for screening variables. This was done by performing two-by-two tests of associations among several pairs of variables in which one of the pairs was utilization of family planning methods. In an attempt to maximize the magnitudes of observed cell frequencies, all variables were reduced to dichotomous variables. For Pearson's chi-square tests of association, observed chi-square values, P-values and the magnitude of Cramer's V statistic (Agresti, 2002) were used as a measure of effect. The tests were done at the 0.05 level of significance. At the 5% level, significant associations are characterized by P-values that are smaller than 0.05 and Cramer's V values that are close to 1.

Table 3.2.1, below, shows that utilization of family planning methods is significantly associated with each of the 16 variables shown in the table. It must be noted that results from the Pearson chi-square test of association are not theoretically as reliable as results obtained from logistic regression analysis or Cox regression. This is because chi-square tests of association take into account the strength of association between two variables only at a time, disregarding the effect of all other variables in the model (Dawson and Trapp, 2004).

**Table 3.2.1: Results from the Pearson chi-square tests of associations**

Variable	Categories	Chi-square value	P-value #	Cramer's V
Easy access to FP services	Yes / No	15.03	< 0.001	0.6961
Age at first pregnancy	< 20 / ≥ 20	16.94	< 0.001	0.5641
Age at first sex	< 20 / ≥ 20	12.65	0.002	0.7871
Family size of respondent	≤ 5 / > 5	10.18	0.001	0.1075
Availability of nearby FP services	Yes / No	11.47	0.001	0.1401
Discussion of FP matters with sexual partner	Yes / No	10.14	0.011	0.1104
Is respondent employed?	Yes / No	10.92	0.011	0.0393
Awareness about FP methods	Yes / No	12.44	0.003	0.0587

and services				
Level of education of respondent	Primary or less / Secondary or above	11.58	< 0.001	0.0496
Level of income of respondent	Low / Average or more	12.45	< 0.001	0.0623
Level of support from sexual partner	Low /Moderate or better	19.56	< 0.001	0.7123
Marital status of respondent	Married / Otherwise	10.61	< 0.001	0.0411
Experience of having sexually transmitted diseases	Yes / No	10.71	< 0.001	0.0859
Level of trust on sexual partner	Inadequate / Moderate or better	10.55	< 0.001	0.0866
Attendance of joint counselling services with sexual partner	Yes / No	11.22	< 0.001	0.0911
Degree of satisfaction with the quality of FP services provided	Inadequate / Moderate or better	26.94	< 0.001	0.5643

**# Significance = P < 0.05.**

The above 16 variables of study were subsequently used for performing logistic regression analysis in an attempt to estimate odds ratios, which are more reliable than P-values estimated from two-by-tests of associations.

### **3.3: Results from logistic regression analysis**

Logistic regression analysis (Hosmer and Lemeshow, 2004) was performed based on a random sample of n=8497 women aged between 15 and 49 years. Out of the 8, 497 women, 3, 547 of them (41.74%) used at least one modern family planning method. The remaining 4, 950 women (58.26%) did not utilize modern family planning methods. In this study, traditional family planning methods such as withdrawal, abstinence, herbs, etc are not recognized as modern family planning methods of contraception.

#### **List of predictor variables used for logistic regression**

The following 16 predictor variables were used for logistic regression. The variables were identified as being influential based on results obtained from Pearson's chi-square tests of associations (Dawson and Trapp, 2004) in which the strength of association of each of the 16 variables shown below with utilization of family planning methods was tested at the 5% level of significance.

- Access to family planning services
- Age at first pregnancy
- Age at first sex
- Attendance of joint counselling services on family planning services
- Family size of respondent
- Availability of nearby family planning services
- Discussion of family planning matters freely with sexual partner
- Employment status of respondent
- Awareness about family planning methods and services
- Level of education of respondent
- Level of income of respondent
- Level of support from sexual partner
- Marital status of respondent
- Experience of having sexually transmitted diseases
- Level of trust on sexual partner
- Degree of satisfaction with the quality of family planning services provided

Table 3.3.1, below, shows estimates obtained from binary logistic regression analysis under the random effects model. The table shows that 8 of the 16 variables used for analysis were significant at the 5% level of significance.

**Table 3.3.1: Estimates obtained from logistic regression analysis with random effects**

Characteristic	*Adjusted Odds Ratio	P-value	95% C. I.
<b>Access to FP services</b>			
Yes (r)	1.00		
No	4.59	< 0.001***	(2.18, 7.38)
<b>Support from sexual partner</b>			
Yes (r)	1.00		
No	4.51	< 0.001***	(2.14, 7.16)
<b>Age at first pregnancy</b>			
20 years or above (r)	1.00		
Less than 20 years	3.08	< 0.001***	(2.04, 6.88)
<b>Counselling services</b>			
Yes (r)	1.00		
No	3.03	0.001***	(2.03, 6.88)
<b>Family size</b>			
≤ 5 (r)	1.00		
> 5	2.89	0.001***	(1.98, 6.57)
<b>Nearby FP services</b>			
Yes (r)	1.00		
No	2.91	0.002***	(1.99, 6.59)
<b>Discussion of FP matters</b>			
Yes (r)	1.00		
No	2.79	0.004***	(1.75, 6.11)
<b>Satisfaction with FP services</b>			
Total satisfaction (r)	1.00		
No satisfaction at all	4.45	< 0.000***	(2.12, 7.03)
Inadequate satisfaction	3.09	0.001***	(2.06, 6.96)
Moderate satisfaction	1.54	0.046*	(1.13, 4.83)
Good satisfaction	1.09	0.049*	(1.09, 4.51)

\* Adjustment was done for religion, level of income, level of education and employment status.

The random effects binary logistic regression model gave an Intra Class Coefficient (rho) of 0.8937 = 89.37%, showing that individual women in the same group resembled each other fairly well.

### Assessment of goodness-of-fit

Goodness-of-fit tests are used in binary logistic regression analysis for assessing the degree of reliability of the fitted model. In this study, the reliability of the fitted model is assessed using commonly used standard diagnostic procedures. Each of the methods used confirms that the fitted model is adequate, and that results obtained from binary logistic regression analysis are highly reliable.

### The classification table

The classification table is the simplest and most commonly used measure of goodness-of-fit in binary logistic regression analysis. The table assesses the capacity of the fitted logistic regression model to accurately classify operators of food outlets as efficient or inefficient in terms of disposing of waste. The table provides measures such as the overall percentage of correct classification, percentage sensitivity and percentage specificity.

**Table 3.3.2: The classification table as a measure of goodness-of-fit**

Diagnostic measure	Percentage
Sensitivity	60.34%
Specificity	95.62%
Positive predictive value	74.47%
Negative predictive value	91.93%
False + rate for true otherwise	4.38%
False - rate for true self initiated VCT	39.66%
False + rate for classified +	25.53%
False - rate for classified -	8.07%
Correctly classified	89.46%

The above classification table shows that the overall percentage of correct classification is 89.46%. The table also shows that the percentages of sensitivity and specificity are 60.34% and 95.62% respectively. These percentages are fairly large. Hence, the fitted logistic regression model is fairly adequate. The percentage of overall correct classification is equal to 89.46%, a figure which is above 75%. This shows that the fitted model is highly reliable in accurately classifying observations.

Sensitivity is an epidemiological measure of the capacity of the fitted model to accurately detect women who are at risk of failure to utilize family planning services. The percentage sensitivity of the fitted model is 60.34%, a figure which is above 50%. This shows that the fitted model is fairly sensitive. Specificity is an epidemiological measure of the capacity of the fitted model to accurately detect women who are not at risk of failure to utilize family planning services for various reasons. The percentage specificity of the fitted model is 95.62%, a figure which is fairly close to 100%. Hence, the fitted model is almost perfectly specific.

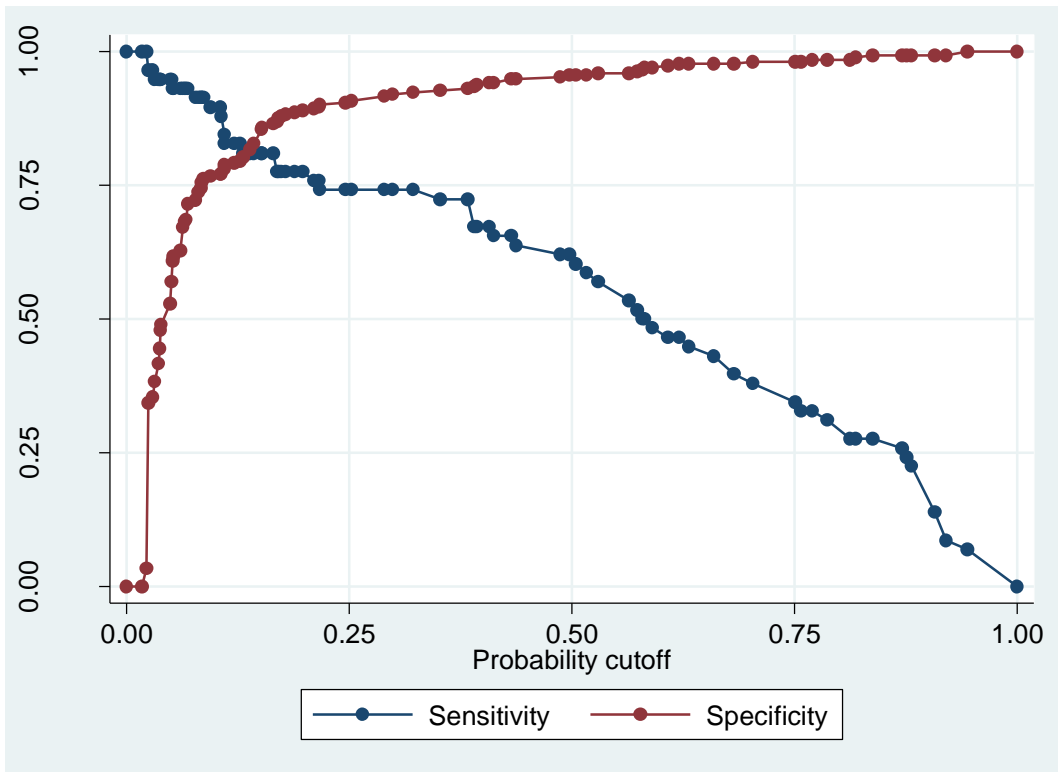
#### **The Hosmer-Lemeshow goodness-of-fit test**

The Hosmer-Lemeshow goodness-of-fit test is used for testing the null hypothesis that there is no reason to doubt the adequacy or reliability of the fitted model. A P-value that is greater than 0.05 shows that the null hypothesis should be accepted at the 5% level of significance, thereby confirming that the fitted model is theoretically reliable. In this study, the P-value from the Hosmer-Lemeshow goodness-of-fit test is equal to 0.0942, a figure which is greater than 0.05. Hence, we have no reason to doubt the reliability of the fitted logistic regression model.

#### **Sensitivity and specificity plots**

Figure 3.3.1 below shows a plot of sensitivity/specificity versus probability cut-off point. The two plots cross each other fairly close to the vertical axis. This shows that the fitted model is adequately sensitive and specific.

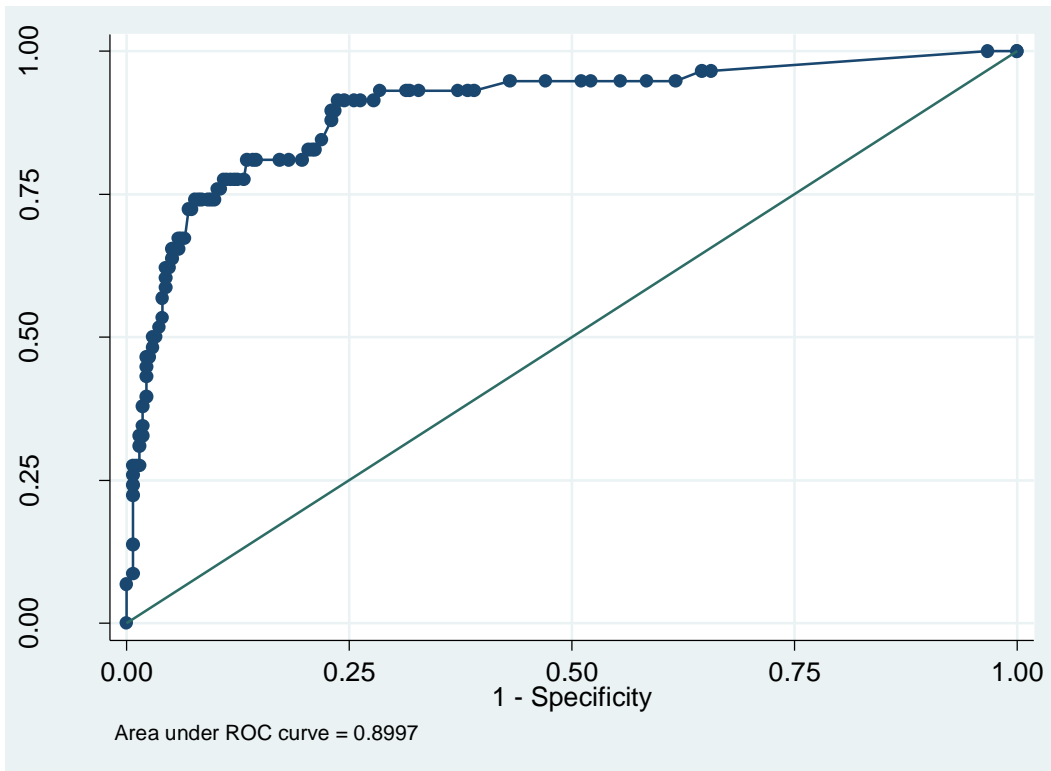
**Figure 3.3.1: Plot of sensitivity/specificity versus probability cut-off point**



### **Magnitude of area lying under the ROC curve**

Figure 3.3.2 below shows a Receiver Operating Characteristic (ROC) plot. The magnitude of the area that lies under the ROC plot is a measure of variation explained by the fitted logistic regression model. In this case, the area under the ROC plot is 89.97%, a figure that is significantly above 75%. The unexplained percentage of variation is equal to roughly 10%. The large percentage of explained variation and the small percentage of unexplained variation show that the fitted model is highly reliable in explaining variability in utilization of modern family planning methods and services as a function of the explanatory variables used for logistic regression analysis.

**Figure 3.3.2: Magnitude of area lying under the Receiver Operating Characteristic (ROC) plot**



### **The likelihood ratio test**

The likelihood ratio test is used for assessing the collective efficiency of the predictor variables constituting the estimated logistic regression model. At the 5% level of significance, a P-value that is smaller than 0.05 shows that the predictor variables that constitute the fitted logistic regression model are jointly efficient. In this case, the P-value from the likelihood ratio test is equal to 0.000, a figure that is smaller than 0.05, thereby confirming that the predictor variables in the fitted logistic regression model are collectively efficient in accounting for failure to utilize family planning services that are provided by the CTMM to the general population.



### **Interpretation of significant odds ratios**

The odds ratio of the variable access to family planning services is 4.59. This shows that a woman who does not have easy access to family planning services is 4.59 times as likely not to utilize family planning services in comparison with another woman who has easy access to family planning services.

The odds ratio of the variable support is 4.51. This shows that a woman who has no support from her sexual partner in terms of utilizing family planning services is 4.51 times as likely not to utilize family planning services in comparison with another woman who enjoys support for doing so from her sexual partner.

The odds ratio of the variable age at first pregnancy is 3.08. This shows that a woman whose age at first pregnancy is below 20 years is 3.08 times as likely not to utilize family planning services in comparison with another woman whose age at first pregnancy is 20 years or above.

The odds ratio of the variable counselling services is 3.03. This shows that a woman who does not attend joint counselling services on family planning services with her sexual partner is 3.03 times as likely not to utilize family planning services in comparison with another woman who attends joint counselling services on family planning services with her sexual partner.

The odds ratio of the variable family size is 2.89. This shows that a woman whose family size is larger than 5 is 2.89 times as likely not to utilize family planning services in comparison with another woman whose family size is less than or equal to 5.

The odds ratio of the variable nearby family planning services is 2.91. This shows that a woman who has no access to nearby family planning services is 2.91 times as likely not to utilize family planning services in comparison with another woman who enjoys nearby family planning services.

The odds ratio of the variable discussion of FP matters is 2.79. This shows that a woman who is unable to discuss family planning matters freely with her sexual partner is 2.79 times as likely not to utilize family planning services in comparison with another woman who can do so.

The variable satisfaction with FP services has 5 categories. The reference category is “Total satisfaction”. Odds ratios are estimated by using the category “Total satisfaction” as a reference category. Hence, there are 4 estimated odds ratios that could be interpreted based on the reference category.

The odds ratio of the category “No satisfaction at all” is equal to 4.45. This shows that a woman who is “not satisfied at all” with the family planning services provided by the CTMM is 4.45 times as likely not to utilize family planning services in comparison with another woman who is totally satisfied with the services provided.

The odds ratio of the category “Inadequate satisfaction” is equal to 3.09. This shows that a woman whose satisfaction with the family planning services provided by the CTMM is “inadequate” is 3.09 times as likely not to utilize family planning services in comparison with another woman who is totally satisfied with the services provided.

The odds ratio of the category “Moderate satisfaction” is equal to 1.54. This shows that a woman whose satisfaction with the family planning services provided by the CTMM is “moderate” is 1.54 times as likely not to utilize family planning services in comparison with another woman who is totally satisfied with the services provided.

The odds ratio of the category “Good satisfaction” is equal to 1.09. This shows that a woman whose satisfaction with the family planning services provided by the CTMM is “good” is 1.09 times as likely not to utilize family planning services in comparison with another woman who is totally satisfied with the services provided.

Adjustment was done for four potential confounding variables: religion, level of income, level of education, and employment status. Unadjusted and adjusted odds ratios did not differ much. This shows that none of the four variables used for adjustment was a confounding or effect modifying variable.

### **3.4: Results from survival analysis**

The aim of the study was to identify factors that significantly affect the long-term occurrence of an adverse outcome of pregnancy among women in the childbearing age category of 15 to 49 years. Analysis was done using the Cox proportional hazards model (Cleves, Gould & Gutierrez, 2004). Hazard ratios were obtained for

key influential predictors of survival. At the 5% level of significance, influential predictors of survival are characterized by hazard ratios that differ from 1 significantly, 95% confidence intervals of hazard ratios that do not contain 1, and P-values that are smaller than 0.05.

Table 3.4.1 compares women who experienced adverse outcomes of pregnancy with those who did not experience adverse outcomes of pregnancy with regards to factors related to the utilization of modern family planning services and socioeconomic status. In the 6-year long period of study, 1, 036 of the 8, 497 women who took part in the study (12.19%) experienced at least one adverse outcome of pregnancy. The other 7, 461 women (87.81%) did not experience any adverse outcome of study during the study period. In survival analysis, the phrase “**Non-survivors**” represents the 1, 036 women who experienced at least one adverse outcome of pregnancy in the study period. The phrase “**Survivors**” represents the 7, 461 women who did not experience any adverse outcome of pregnancy in the study period. Out of the 1, 036 women who experienced adverse outcomes of pregnancy, 819 (79.05%) were nonusers of family planning methods whereas 217 of them (20.95%) were users of family planning methods.

**Table 3.4.1: Group proportions with regards to adverse outcomes of pregnancy**

Predictor variable	Survivors (n=7461)	Non-survivors (n=1036)
Access to FP services	Yes: 54% No: 46%	Yes: 24% No: 76%
Unwanted pregnancy	Yes: 13% No: 87%	Yes: 79% No: 21%
Age at first pregnancy	13 to 19: 39% 20 or above: 61%	13 to 19: 77% 20 or above: 23%
Utilization of FP services	Yes: 36% No: 64%	Yes: 11% No: 89%
Discussion of FP matters with sexual partner	Yes: 29% No: 71%	Yes: 2% No: 98%

Family size	≤ 5 : 58% < 5 : 42%	≤ 5 : 29% < 5 : 71%
Nearby FP services	Yes: 58% No: 42%	Yes: 32% No: 68%
Average monthly income	Very low (14%) Low (21%) Average (39%) Above average (19%) High (7%)	Very low (29%) Low (43%) Average (34%) Above average (3%) High (1%)
Highest level of education	No education: 8% Primary: 11% Secondary: 58% Post-secondary: 23%	No education: 15% Primary: 29% Secondary: 52% Post-secondary: 4%
Employment	Yes: 31% No: 69%	Yes: 8% No: 92%

Table 3.4.1 shows that women who experienced at least one adverse outcome of pregnancy during the 6-year long study period are significantly different from those who did not experience any adverse outcome of pregnancy with regards to the variables of comparison. It can be seen from the table that “**non-survivors**” or women who have experienced at least one adverse outcome of pregnancy are characterized by lack of easy access to modern family planning services, poor utilization of family planning services, inability to discuss family planning matters with their sexual partners, large family sizes, unwanted pregnancies, young age (teenagers during their first pregnancies), low monthly income, low level of education, and unemployment.

Kaplan-Meier survival probability plots were used for comparing the survival probabilities of women with regards to utilization of modern family planning methods such as contraceptives. The plot shown below in Figure 3.4.1 shows that women who used modern family planning methods such as contraceptives (FP use) have a larger probability of survival in comparison with women who did not use modern family planning services such as contraceptives (No FP use).

**Figure 3.4.1: Kaplan-Meier survival estimates, by utilization of family planning methods**

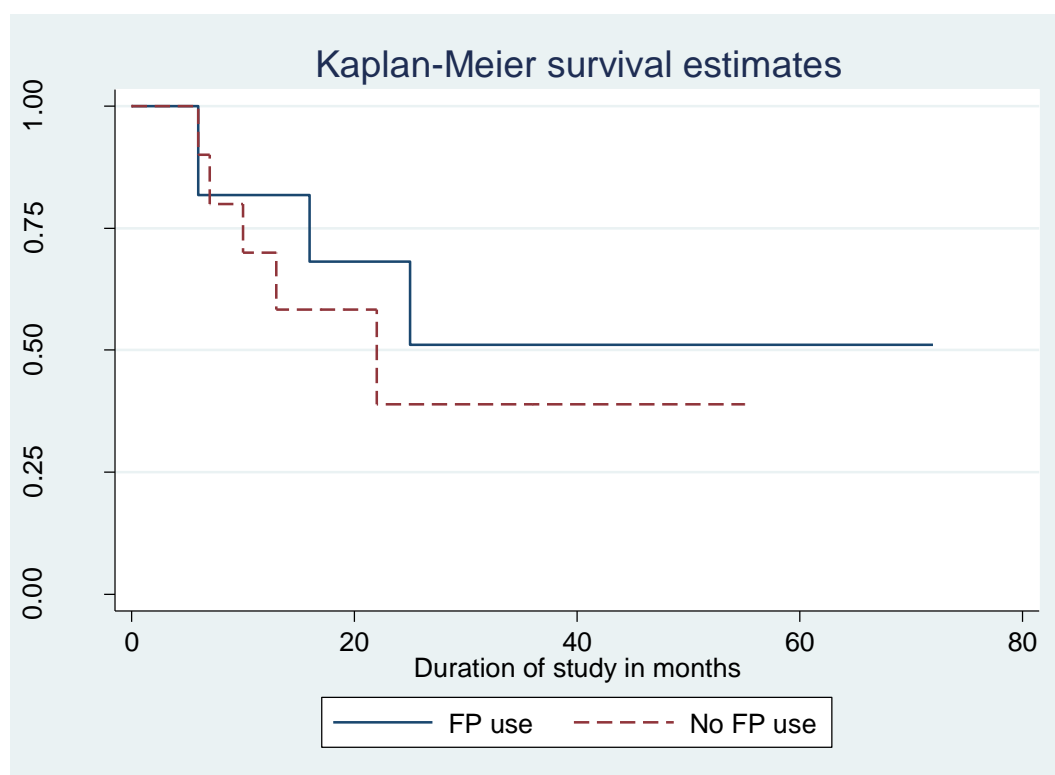


Table 3.4.2 shows hazard ratios estimated from Cox regression. The table shows that the loss of a foetus or adverse outcomes of pregnancy is most strongly influenced by 6 of the 12 predictor variables used for survival analysis. These 6 influential predictor variables are: access to family planning services, unwanted pregnancy, age at first pregnancy, utilization of family planning services, family size and availability of nearby family planning services, in a decreasing order of influence.

**Table 3.4.2: Adjusted hazard ratios from the Cox Proportional Hazards Model**

Variable	*Adjusted Hazard Ratio	P-value	95% CI
Access to FP services	4.02	< 0.001	(2.13, 6.59)
Unwanted pregnancy	3.79	0.001	(1.24, 5.69)
Age at first pregnancy	2.89	0.003	(1.19, 4.22)
Utilization of FP services	2.84	0.004	(1.14, 4.18)
Family size	2.83	0.005	(1.13, 4.17)
Nearby FP services	2.79	0.007	(1.11, 4.14)

\* Adjustment was done for level of income, level of education and employment status.

### **Interpretation of significant hazard ratios**

The hazard ratio of the variable access to family planning services is 4.02. This shows that a woman who does not have easy access to family planning services is 4.02 times as likely to lose a foetus in comparison with another woman who has easy access to family planning services.

The hazard ratio of the variable unwanted pregnancy is 3.79. This shows that a woman who becomes pregnant without being prepared for the challenge is 3.79 times as likely to lose a foetus in comparison with another woman who becomes pregnant out of her own good will.

The hazard ratio of the variable age at first pregnancy is 2.89. This shows that a woman whose age at first pregnancy is below 20 years is 2.89 times as likely to lose a foetus in comparison with another woman whose age at first pregnancy is 20 years or above.

The hazard ratio of the variable utilization of family planning services is 2.84. This shows that a woman who does not utilize family planning services regularly is 2.84 times as likely to lose a foetus in comparison with another woman who utilizes family planning services regularly.

The hazard ratio of the variable family size is 2.83. This shows that a woman whose family size is larger than 5 is 2.83 times as likely to lose a foetus in comparison with another woman whose family size is less than or equal to 5.

The hazard ratio of the variable nearby family planning services is 2.79. This shows that a woman who has no access to nearby family planning services is 2.79 times as likely to lose a foetus in comparison with another woman who enjoys nearby family planning services.

Adjustment was done for three potential confounding variables: sub-district, employment status and level of education. Unadjusted and adjusted hazard ratios did not differ much. This shows that none of the three variables used for adjustment was a confounding or effect modifying variable. The adequacy of the fitted Cox model was assessed using log-minus-log plots, the likelihood ratio test and the AIC (Akaike's Information Criterion) as diagnostic procedures. All log-minus-log plots were parallel, showing that the assumption of proportional hazards was satisfied. The P-value from the likelihood ratio test was small ( $0.0001 < 0.01$ ), thereby

showing that the 6 variables constituting the fitted Cox model were jointly efficient in explaining variability in long term survival at the 1% level of significance. The estimated value of the AIC statistic was also small (10.44), thereby showing that the discrepancy between the fitted and true models was insignificant.

The results obtained from Cox regression are fairly similar to those obtained from Pearson's chi-square tests of association (Dawson and Trapp, 2004), log-linear analysis (Agresti, 2002), logit regression, probit regression, the log-rank test, Cox regression, Weibull regression and log-normal regression (Greene, 2003). In each of the methods used, the appropriate measures of effect have been used for identifying influential predictor variables. Hazard ratios estimated based on longitudinal studies are theoretically the most reliable measures of effect in impact studies (Verbeek, 2000).

### 3.5: Results from multilevel analysis

Table 3.5.1 shows covariance parameter estimates obtained from multilevel analysis. The results enable us to calculate the percentage of variance attributed to differences among the 20 service delivery wards and the 11 health facilities rendering family planning services to the 3, 547 FP users in the study.

**Table 3.5.1: Covariance parameter estimates obtained from multilevel analysis**

Variance	Estimate	P-value
Wards	0.1736	< 0.001
Facilities	0.1880	< 0.001
Error	1.0285	0.176
Total variance	1.3901	

The P-values obtained in Table 3.5.1 for wards and facilities are both less than 0.05. Hence, at the  $\alpha = 0.05$  level of significance, the effects of wards and facilities are both highly significant. That is, the difference among the 20 service delivery wards is highly significant at the 5% level. Likewise, the difference among the 11 service delivery facilities is also highly significant at the 5% level.

## The percentage of variance attributed to differences among wards and facilities

- (1) Estimation of the percentage of variance attributed to differences among wards

$$ICC = \frac{\text{Variance due to wards}}{\text{Total variance}} = \frac{0.1736}{1.3901} = 0.1249 = 12.49\%$$

Hence, the difference among the 20 service delivery wards accounts for 12.49% of total variation.

- (2) Estimation of the percentage of variance attributed to differences among facilities

$$ICC = \frac{\text{Variance due to facilities}}{\text{Total variance}} = \frac{0.1880}{1.3901} = 0.1352 = 13.52\%$$

Hence, the difference among the 11 health service facilities accounts for 13.52% of total variation.

- (3) Estimation of the percentage of variance attributed to facilities and wards jointly

$$ICC = \frac{\text{Facility variance} + \text{Ward variance}}{\text{Total variance}} = \frac{0.1880 + 0.1736}{1.3901} = \frac{0.3616}{1.3901} = 0.2601 = 26.01\%$$

Hence, facilities and wards jointly account for 26.01% of the total variation.

- (4) Estimation of the percentage of variance attributed to differences in facilities within the same wards

$$ICC = \frac{\text{Ward variance}}{\text{Ward variance} + \text{Facility variance}} = \frac{0.1736}{0.1736 + 0.1880} = \frac{0.1736}{0.3616} = 0.4801 = 48.01\%$$

Facilities nested within the same wards are quite different from each other. They are significantly different from each other (48%) with regards to service delivery.

- (5) Estimation of variance attributed to differences in individual women that receive services within the same health facilities

ICC = Variance attributed to differences among facilities – Variance attributed to differences among wards = 13.52% - 12.49% = 0.0103 = 1.03%. This figure is quite small, and shows that women receiving family planning services within health facilities are quite similar.

Table 3.5.2 shows regression coefficients estimated from multilevel analysis. The table shows that the choice of contraceptives is strongly influenced by 9 of the 11 variables used for analysis. These 9 influential variables are:



access to FP services, support from sexual partner, age at first pregnancy, counselling services, family size, the availability of nearby FP services, discussion of FP matters with sexual partner, and degree of satisfaction (no satisfaction at all, and inadequate satisfaction), in a decreasing order of influence.

**Table 3.5.2: Adjusted regression coefficients estimated from multilevel analysis**

Characteristic	*Regression coefficient	P-value	95% C. I.
Access to FP services	1.52	< 0.001***	(0.77, 2.01)
Support from sexual partner	1.50	< 0.001***	(0.76, 1.97)
Age at first pregnancy	1.11	< 0.001***	(0.71, 1.93)
Counselling services	1.10	0.001***	(0.71, 1.93)
Family size	1.06	0.001***	(0.68, 1.88)
Nearby FP services	1.05	0.002***	(0.67, 1.85)
Discussion of FP matters	1.02	0.004***	(0.55, 1.81)
No satisfaction at all	1.48	0.000***	(0.75, 1.95)
Inadequate satisfaction	1.13	0.001***	(0.72, 1.94)
Moderate satisfaction	0.43	0.046*	(0.12, 1.57)
Good satisfaction	0.09	0.049*	(0.02, 0.16)

\* Adjustment was made for clusters

### Diagnostic measure for multilevel analysis

The **likelihood ratio test** is used for assessing the adequacy of the fitted model. This is done by testing the significance of between-women variability as a random effect.

**Null hypothesis:** Insignificant random slope

**Alternative hypothesis:** Significant random slope

**Decision rule:** At the  $\alpha = 0.05$  level of significance, the null hypothesis is rejected if  $P < \alpha$ .

The P-value from the likelihood ratio test is equal to  $0.0003 < 0.05$ . Hence, we conclude that the random slope is significant at the 5% level.

### **3.6 Missing values**

The number of missing values in the study was only 23 out of 8, 497 respondents who were followed up during the period of study (01 January 2004 to 31 December 2009). The 23 missing values were confirmed to have missed completely at random (MCAR). According to Enders (2010), list wise deletion is an ad hoc method of dealing with missing data with MCAR. As such, missing data were dealt with before any substantive analyses were done. According to Enders (2010), list wise deletion is considered the easiest and simplest method of dealing with missing data with MCAR. The procedure involved removing incomplete cases from the data set. In view of the large sample size of study ( $n=8, 497$ ), the reliability of estimates obtained from data analysis was not affected much. Data are missing completely at random when the probability of obtaining a particular pattern of missing data are not dependant on the values that are missing and when the probability of obtaining the missing data pattern in the sample is not dependant on the observed data. An advantage in using list wise deletion is that all analyses are calculated with the same set of cases.

## **CHAPTER 4: DISCUSSION OF RESULTS**

### **4.1 Major findings of study**

The two specific objectives of this study were to identify key predictors of adverse outcomes of pregnancy among women aged between 15 and 49 years living in and around the City of Pretoria, and to assess the degree of utilization of modern family planning methods. The study aims to provide adequate answers to the following key research questions of interest:

1. What are the key factors that are responsible for adverse outcomes in pregnancy among women aged between 15 and 49 years living in and around the City of Pretoria?
2. What is the degree of utilization of modern contraceptives?
3. What are the key factors that affect utilization of family planning services provided by the CTMM to women aged between 15 and 49 years living in and around the City of Pretoria?
4. Does utilization of contraceptives and modern family planning methods vary by service delivery wards and facilities?

#### **Key findings from univariate analysis**

The study consisted of a total of 8, 497 women in the childbearing age of 15 to 49 years who lived in 2, 075 households scattered over the four health sub-districts of the CTMM. Out of the 8, 497 women who took part in the study, 3, 547 women (41.74% of them) utilized at least one modern family planning (FP) method such as contraceptives regularly. The remaining 4, 950 women (58.26%) did not utilize any modern family planning method. The average age of FP users at first sex was 18.72 years. The average age of FP users at first pregnancy was equal to 19.36 years. The prevalence of teenage pregnancy among the 8, 497 women in the study was equal to 9.5%. The prevalence of adverse outcomes of pregnancy among the 8, 497 women in the study was equal to 12.19%. Injections (54.03%) were most commonly used as a means of modern contraception by the 3, 547 women who used modern contraceptives, followed by pills (19.60%), condoms (15.51%), intra-uterine devices (8.20%), sterilization (2.37%), and vaginal foams (0.28%). The average ages of women at first sex and pregnancy were 18.72 and 19.36 years respectively.

### **Key findings from Pearson's chi-square tests of associations**

Based on results obtained from Pearson's chi-square tests of associations, utilization of modern family planning methods and contraceptives was significantly associated with low family size (5 or less), the availability of nearby FP facilities, and low age at first sex.

### **Key findings from logistic regression analysis**

Based on odds ratios estimated from logistic regression analysis, utilization of modern family planning methods such as contraceptives was significantly influenced by easy access to services (OR=4.59; 95% CI = 2.18 – 7.38), degree of support from sexual partners (OR=4.51; 95% CI = 2.14 – 7.16), and degree of satisfaction with the quality of services provided at service centers (OR=4.45; 95% CI = 2.12 – 7.03). The odds ratio of the variable access to family planning services is 4.59. This shows that a woman who does not have easy access to family planning services is 4.59 times as likely not to utilize family planning services in comparison with another woman who has easy access to family planning services. The odds ratio of the variable support is 4.51. This shows that a woman who has no support from her sexual partner in terms of utilizing family planning services is 4.51 times as likely not to utilize family planning services in comparison with another woman who enjoys support for doing so from her sexual partner. The odds ratio of the variable age at first pregnancy is 3.08. This shows that a woman whose age at first pregnancy is below 20 years is 3.08 times as likely not to utilize family planning services in comparison with another woman whose age at first pregnancy is 20 years or above. The odds ratio of the variable counselling services is 3.03. This shows that a woman who does not attend joint counselling services on family planning services with her sexual partner is 3.03 times as likely not to utilize family planning services in comparison with another woman who attends joint counselling services on family planning services with her sexual partner. The odds ratio of the variable family size is 2.89. This shows that a woman whose family size is larger than 5 is 2.89 times as likely not to utilize family planning services in comparison with another woman whose family size is less than or equal to 5. The odds ratio of the variable nearby family planning services is 2.88. This shows that a woman who has no access to nearby family planning services is 2.88 times as likely not to utilize family planning services in comparison with another woman who enjoys nearby family planning services. The odds ratio of the variable discussion of FP matters is 2.79. This shows that a woman who is unable to discuss family planning matters freely with her sexual partner is 2.79 times as likely not to utilize family planning services in comparison with another woman who can do so. The odds ratio of the category "No satisfaction at all" is equal to 4.45. This shows that a woman who is "not satisfied

at all” with the family planning services provided by the CTMM is 4.45 times as likely not to utilize family planning services in comparison with another woman who is totally satisfied with the services provided. The odds ratio of the category “Inadequate satisfaction” is equal to 3.09. This shows that a woman whose satisfaction with the family planning services provided by the CTMM is “inadequate” is 3.09 times as likely not to utilize family planning services in comparison with another woman who is totally satisfied with the services provided. The odds ratio of the category “Moderate satisfaction” is equal to 1.54. This shows that a woman whose satisfaction with the family planning services provided by the CTMM is “moderate” is 1.54 times as likely not to utilize family planning services in comparison with another woman who is totally satisfied with the services provided. The odds ratio of the category “Good satisfaction” is equal to 1.09. This shows that a woman whose satisfaction with the family planning services provided by the CTMM is “good” is 1.09 times as likely not to utilize family planning services in comparison with another woman who is totally satisfied with the services provided.

### **Key findings from survival analysis**

Based on hazard ratios estimated from the Cox Proportional Hazards Model, the occurrence of adverse outcomes of pregnancy was significantly influenced by easy access to family planning services (HR=4.02; 95% CI = 2.13 – 6.59), unwanted pregnancy (HR=3.79; 95% CI = 1.24 – 5.69), and young age at first pregnancy (HR=2.89; 95% CI = 1.19 – 4.22). Adjustment was done for religion, level of income, level of education and employment status. The hazard ratio of the variable access to family planning services is 4.02. This shows that a woman who does not have easy access to family planning services is 4.02 times as likely to lose a foetus in comparison with another woman who has easy access to family planning services. The hazard ratio of the variable unwanted pregnancy is 3.79. This shows that a woman who becomes pregnant without being prepared for the challenge is 3.79 times as likely to lose a foetus in comparison with another woman who becomes pregnant out of her own good will. The hazard ratio of the variable age at first pregnancy is 2.89. This shows that a woman whose age at first pregnancy is below 20 years is 2.89 times as likely to lose a foetus in comparison with another woman whose age at first pregnancy is 20 years or above. The hazard ratio of the variable utilization of family planning services is 2.84. This shows that a woman who does not utilize family planning services regularly is 2.84 times as likely to lose a foetus in comparison with another woman who utilizes family planning services regularly. The hazard ratio of the variable family size is 2.83. This shows that a woman whose family size is larger than 5 is 2.83 times as likely to lose a foetus in comparison with another woman whose family size is less than or equal to 5. The hazard ratio of the variable nearby family planning services is 2.79. This shows that a woman who has no

access to nearby family planning services is 2.79 times as likely to lose a foetus in comparison with another woman who enjoys nearby family planning services.

### **Key findings from multilevel analysis**

Based on findings from multilevel analysis, contraceptive use varied significantly from ward to ward (20 service delivery wards) as well as from facility to facility (11 service delivery facilities). The difference among the 20 service delivery wards accounted for 12.49% of total variation in the quality of services delivered to women of the childbearing age of 15 to 49 years of age. The difference among the 11 health service facilities accounted for 13.52% of total variation in the quality of services delivered to women of the childbearing age of 15 to 49 years of age. Health facilities and wards jointly accounted for 26.01% of the total variation. Facilities nested within the same wards were significantly different (48%) from each other. This shows that health facilities were not homogeneous in nature, and that it mattered which health facility women went to in order to receive family planning services. This finding clearly shows that services at the level of facilities were not standardized adequately. That is, some facilities were doing much better than others although all facilities are supposed to be equally efficient in terms of service delivery. For example, health facilities rendering family planning services in predominantly white suburbs were significantly better equipped and well resourced in comparison with facilities rendering services in predominantly black suburbs such as Mamelodi. Intervention is required by the CTMM to address this challenge. Finally, results obtained from multilevel analysis show that women receiving family planning services within the same health facilities shared similar characteristics with each other.

### **4.2. Discussion of results**

The study showed that unwanted pregnancy and adverse pregnancy outcomes among poor black women constitute a major health problem in and around the City of Pretoria, South Africa. There is a dire need for the promotion of community based family planning services specifically aimed at poor women with ages 15 to 49 years. While it is true that community based clinics are the most efficient health service centers for promoting the use of modern contraceptives and family planning methods, the facilities are underutilized in comparison with hospitals and private sector service providers.

The study was aimed at assessing the quality of reproductive health and family planning services provided to women in the childbearing age of 15 to 49 years of age who reside in the four health sub-districts of the City of

Tshwane Metropolitan Municipality (CTMM). The study has investigated factors that are responsible for adverse outcomes of pregnancy and poor utilization of family planning services provided to the general public by the CTMM. The design of the study is longitudinal. The study was conducted over a 6-year period between 2004 and 2009. The questionnaire of study was filled in by respondents once a year. Observed values of variables were recorded at the end of the study period (31 December 2009). For survival analysis, data gathered between 01 January 2004 and 31 December 2009 were used.

Out of the 8, 497 women who took part in the study, 4, 950 of them (58.26%) did not use modern family planning methods and reproductive health services provided to the general population at 20 service delivery wards and 11 health facilities. The percentage of women who regularly used modern family planning methods such as condoms, pills, injections, intra-uterine devices and sterilization was 41.74%. The average ages of women at first sex and pregnancy were 18.72 and 19.36 years respectively. Adverse outcomes of pregnancy occurred in 12.19% of women. Injections (54.03%) were most commonly used as a means of modern contraception by the 3, 547 women who used modern contraceptives, followed by pills (19.60%), condoms (15.51%), intra-uterine devices (8.20%), sterilization (2.37%), and vaginal foams (0.28%). The demand for modern family planning methods and contraceptives is robust in District 3 (74%), followed by District 2 (72%), followed by District 1 (53%), and finally by District 4 (43%).

The study has found out the reasons for the underutilization of modern family planning services and contraceptives among women in the childbearing age of 15 to 49 years. Nearly 23% of the 4, 950 nonusers of contraceptives in the study preferred not to utilize contraceptives due to fear of side effects. Desire for children has been cited by 19.5% of nonusers as a reason for not using contraceptives. Nearly 5% of husbands of nonusers disapprove of contraceptives at the household level. Almost 10% of all nonusers do so due to lack of information on the benefits of contraceptives. Based on recommendations made by the United Nations Millennium Development Goals (2007), the provision of health education on family planning services and contraceptives should be actively promoted so that sexually active boys and girls get to know about the choices they could make. This could be done efficiently by providing integrated services that are linked to the school curriculum as well as community based initiatives in which all stakeholders apply the necessary effort for reducing maternal morbidity and mortality attributed to teenage pregnancy.

The study makes a comprehensive comparison between FP users and nonusers with regards to key socioeconomic, demographic and health-related characteristics. The comparison showed that FP users and nonusers were fairly similar with regards to age distribution. The mean ages of FP users and nonusers were 29.6 and 29.3 respectively. The median ages of users and non-users were 29.4 and 29.2 respectively. The average number of children living with their mothers for users and nonusers were 1.3 and 1.1 respectively. However, the two groups were significantly different from each other with regards to key socioeconomic variables such as level of education, family size, income, the prevalence of adverse outcomes of pregnancy, marital status, the number of children living with their mothers, as well as employment status. FP users were marginally older than nonusers, and had slightly more children living with them. Users were relatively better educated in comparison with nonusers, and had a relatively better income and smaller family size in comparison with nonusers. More FP users were married in comparison with nonusers. The prevalence of adverse outcomes of pregnancy was significantly higher in nonusers (16.55%) than in users (6.12%).

FP users were found to be generally better educated in comparison with nonusers. FP users were also shown to be economically better off in comparison with nonusers. As many as 63.4% of FP users had secondary level education, 8.6% of them had post-secondary level of education, only 1.9% of them had no formal education. By contrast, 43.94% of nonusers had secondary level education, 5.4% of them had post-secondary level education, and 3.94% of them had no formal education. In terms of average monthly income, 14.2% of FP users had an average monthly income between 6, 001 and 12, 000 Rand. The corresponding figure for nonusers was 9.9%. FP users seem to be slightly better off than nonusers with regards to average monthly income. These findings are consistent with reports produced by the South African National Department of Health, the South African Medical Research Council and ORC MACRO (2007).

In terms of employment opportunities, 26.5% of FP users were employed, whereas only 16.8% of nonusers were employed. Nearly 46% of FP users and 57% of nonusers were unemployed.

The percentage of married FP users (41%) was smaller than the percentage of married nonusers (45%). The percentage of FP users who were living together with their sexual partners (35.3%) was much higher than the percentage of nonusers who were living together with their sexual partners (26.25). In general, married women accounted for the largest percentage of FP users and nonusers. FP users and nonusers were fairly similar with regards to experiencing sexually transmitted diseases, ownership of flush toilets, access to tap water at home, and level of trust on sexual partners.



South Africa's experience in the fertility transition is among the most advanced in sub-Saharan Africa. South Africa displays demographic regimes that are typical of both developed and developing worlds. These tend to be linked to socio-economic divisions along racial and urban-rural lines. Living standards are closely correlated with race in South Africa. While poverty is not confined to any one racial group in South Africa, it is concentrated among Africans in particular. Many of the apartheid measures, including the extensive welfare system available to White people, the higher quality of education available to White students, and the formal and informal job reservations for White workers, was specifically designed in preventing poverty among the White population. According to the most recent General Household Survey conducted by Statistics South Africa (2009), household level poverty among white South Africans is significantly smaller than household level poverty among black South Africans. Almost half of poor and black South African mothers residing in the CTMM do not have the financial means to purchase and utilize contraceptives from private pharmacies. As a result, they rely on the CTMM to provide them with modern contraceptives free of charge as part of its service to the general population. In addition to making modern contraceptives freely available to black women, it is also necessary to promote awareness and health education campaigns in order to empower more women on family planning and reproductive health matters. The need to do so has been pointed out by the UNAIDS (2010) and Kaufmann, De Wet & Stadler (2001).

The CTMM needs to consider practical steps in which services provided at the 20 service delivery wards and 11 health facilities could be radically improved with a view to improve the quality of family planning and reproductive health services provided to the general population, with a particular emphasis on black women in the childbearing age of 15 to 49 years. The differences in poverty by race also contribute to the distribution of poverty by location since the racial groups were unevenly distributed in the country. At the same time, among Africans, the group comprising nearly all the country's poor, the pattern of much higher poverty in rural areas and the concentration of poverty in the former homelands and some of the provinces still holds. According to the Human Sciences Research Council (2010) and the World Bank (2009), the fertility trends among population groups in South Africa follow the same patterns as that of poverty. The African component which is the poorest with regard to per capita income has the highest fertility rate, while the White population which has the highest per capita income has the lowest fertility rate.

According to estimates obtained from the South African Human Sciences Research Council (2010) and Statistics South Africa (2009), the current total fertility rate (TFR) of South Africa is roughly equal to 3.0. White South Africans experienced a long and sustained fertility decline from the end of the 19th century until they attained a below-replacement fertility rate of 1.9 in 1989. Fertility rates also declined in Asian families from about 6 in the 1950s to 2.7 in the late 1980s. Fertility rates declined sharply in Coloured families from 6.5 in the late 1960s to about 3.0 by the late 1980s. Fertility rates in black South Africans declined from a high of 6.8 to a low of about 3.9 between the mid-1950s and the early 1990s. Although fertility rates continue to decline in South Africa, fertility rates in black South Africans are higher than that of the other racial groups (whites, Asians and Coloureds). The South African Regional Poverty Network (2004), the Population Council (2010), the United Nations Development Programme (2004) and the World Bank (2009) recommend that modern contraceptives and family planning methods should be made available to all needy women in the childbearing age of 15 to 49 years living in Sub-Saharan African countries as a strategic means of achieving sustained economic growth and development.

The study shows that teachers (19%), relatives (17%), friends (15%) and physicians (14%) are the most preferred sources of first information on condoms, whereas friends (58%), mothers (57%), sisters (56%), nurses (54%) and relatives (53%) are the preferred sources of first information on injections, respectively. The least preferred sources of first information on condoms and injections are sisters (10%), teachers (47%) and physicians (47%), respectively. The most preferred sources of first information on IUDs, pills and sterilizations are teachers (11%), physicians (24%) and relatives (17%). The least preferred sources are relatives (2%) and mothers (6%), respectively.

The top three preferred methods of contraception among women who currently have a sexual partner are injections (55%), pills (19%) and sterilization (11%). Condoms (20.5%) and injections (50.4%) are also popular with women who do not have sexual partners. The table shows that 55% of women who live with two or more children rely on injections as a means of contraception. A sizeable percentage of women who have given birth to children (40.7%) rely on injections as a means of contraception.

The study has shown that the use of condoms is positively associated with level of education. Women with post-secondary level of education are four times as likely to use condoms in comparison with women with no formal education. A similar pattern is observed in IUDs and pills to a lesser extent. The patterns for injections and

sterilizations are, however, somewhat different. The choice of injections is significantly high (63%) in women with no formal education. The choice of sterilizations increases from 14% in women with no formal education to 16% in women with primary level of education. The choice of condoms is the lowest among married women (1%), followed by widowed women (7%). The choice of condoms is highest among never married women (29%) and women separated from their husbands (27%). The demand for injections is high among women who live together with their husbands or sexual partners (62%), women who are married (59%), women who are divorced (57%), women who are separated from their husbands or sexual partners (42%), women who have never been married (42%), and widowed women (39%). The use of IUDs, pills and sterilizations shows no visible pattern by marital status. The choice for IUDs is highest among widowed women (21%), followed by never married women (9%), and women who live together with their husbands or sexual partners (8%). Pills are quite popular among married women (21%), followed by widowed women (18%), as well as women who have never been married (17%). Sterilization is least appreciated by young women who have never been married (3%).

With regards to District of residence, the use of condoms is highest in District 4 (22%), followed by District 1 (18%), followed by District 3 (11%), and finally by District 2 (7%). The demand for injections is higher in District 2 (66%) and District 3 (62%) than in District 4 (46%) and District 1 (32%). The demand for IUDs (11%) and pills (39%) is highest in District 3. District 4 (4%) and District 3 (5%) have the lowest demand for IUDs. Sterilization is higher in the two rural districts (District 4 with 21% and District 3 with 11%) than in the two urban districts (District 1 with 6% and District 2 with 3%).

More students use condoms (38%) than women who are employed (10%) and women who are not employed (8%). Pills are used by 25% of students, 21% of employed women, and 13% of unemployed women. The use of injections increases from 31% in students to 55% and 58% in employed and unemployed women, respectively. The use of sterilization increases from 1% in students to 9% and 11% in employed women and unemployed women respectively. The study shows that the use of condoms (31%), IUDs (9%) and pills (18%) is robust among women who have never given birth, in comparison with women who have given birth. The opposite is true with injections and sterilizations. Condoms (32%) and sterilizations (15%) are widely used by women who have no living children.

Private pharmacies (23%) and private health sector (13%) are the main suppliers of condoms while pills (18%) and injections (54%) are supplied mostly by the public health sector. The supply of IUDs (13%) is highest in the private sector. Sterilizations (12%) are highest in private pharmacies. These findings are consistent with the

current distribution of reproductive health care providers in and around the City of Pretoria where private pharmacies and private health care providers outnumber public sector care providers significantly.

The study has shown that the use of contraceptives varies significantly depending on the marital status of women. The study has shown that 66% of married women ( $P=0.0001$ ), 60% of women living together with their sexual partners ( $P=0.0002$ ), 79% of widowed women ( $P=0.0103$ ), and 37% of divorced women ( $P=0.0103$ ) are less likely to utilize contraceptives in comparison with women who have never been married. Women who do not live with their husbands or sexual partners are 76% ( $P=0.0001$ ) less likely to use contraceptives in comparison with women who live together with their husbands or sexual partners. These results are consistent with findings reported by the United Nations Populations Fund (2009).

Results obtained from multinomial logistic regression analysis have shown that condoms are much more popular with young women in comparison with older women. The odds of choosing condoms instead of pills in 15-24 or 25-34 year olds are 1.41 or 1.48 times higher in comparison with women in the 35-49 age category. The results show that the use of condoms is significantly associated with young age ( $P=0.0032$ ), and that the use of injections is significantly associated with old age ( $P=0.0001$ ). These results show that the use of condoms is preferred by young women, whereas the use of injections and IUDs is preferred by women in the 25-34 and 35-49 age categories. Married women are 94% less likely ( $P=0.0001$ ) to choose condoms instead of pills; are 72% less likely ( $P=0.0104$ ) to choose IUDs instead of pills, and are 69% times ( $P=0.0012$ ) less likely to choose IUDs instead of injections, in comparison with women who have never been married. Employed women with high level of education are more likely to get contraceptives such as pills and condoms from private pharmacies ( $OR=2.28$ ;  $P=0.0029$ ) in comparison with public health facilities. The choice of pills is higher in the private health sector than in the public health sector ( $OR=2.98$ ,  $P=0.0003$ ). The choice of contraceptives follows racial and income-based stratification. Whites make the least use of public family planning services, and choose from a wider range of contraceptive methods. Blacks constitute the bulk of clients seeking assistance in family planning services, and predominately use contraceptive injections. This raises questions about information sharing and the widening of reproductive choices, as well as the issue of women's control over their own bodies and their sexuality.

The average age at first pregnancy is 19.36 years for FP users. The corresponding figure for nonusers is 18.74. The vast majority of women who experienced teenage pregnancy were black, and are characterized by low level of income and no formal education. Teenage pregnancy is a cause of concern for the CTMM and the South African National Department of Health. Marriage and contraceptive use are two of the most powerful determinants of fertility. In most populations, fertility is directly related to marriage. Married women generally have more children than unmarried women of the same age. Traditionally, births to unmarried women were not accepted in most societies, thus women began bearing children after marriage and continued throughout their reproductive lifetime as long as they remained married. In Africa, marriage used to be almost universal and marital fertility was high while non-marital fertility was very low. In the South African context, marriage seems to have lost its value as a determinant of fertility. This can be seen, firstly, from the small and insignificant difference between marital and non-marital fertility of black South African women in the childbearing age of 15 to 49 years.

In this study, 22% of pregnancies were not desired by the mother. Such pregnancies could have been better planned if the mother were adequately empowered. This clearly shows that there is a need for counselling and health education services. Teenage pregnancy has dire socioeconomic and health-related consequences, especially for poor, unemployed women. The majority of these pregnancies are neither planned nor wanted. The father of the child is quite reluctant to accept responsibility for the child. The mother often leaves school, thus ending her opportunities for personal development, making her vulnerable to poverty, exploitative sexual relationships and violence as well as low self-esteem. This study has shown that women who have had adverse outcomes of pregnancy are characterized by low income and low level of education. The plight of victims of adverse outcomes of pregnancy is a challenge to be addressed in a constructive manner, especially in light of the spread of HIV/AIDS, as well as the fact that the human rights of many teenage girls are infringed through acts of sexual abuse and rape. The negative implications of this situation manifest themselves as unwanted pregnancies, abortions, abandoned and street children, child neglect and abuse. This assessment is by and large in agreement with research findings published by the South African Regional Poverty Network (2004).

### 4.3 Limitations of study

The study has the following three minor limitations:

- The United Nations Development Programme (2004), the World Bank (2010) and Moskowitz & Jennings (2005) maintain that the use of contraceptives must not be imposed on the female population as a means of realizing sustained economic growth and development. While there is plenty of evidence showing that the use of modern contraceptives and family planning methods does contribute for overall economic growth and development, the use of contraceptives is a controversial issue to South African Catholics and Anglicans. According to the South African Catholic Church (2010), there are approximately 3.3 million Catholics in South Africa, just over 6% of the total population. Out of these, 2.7 million are of various black African ethnic groups, such as Zulu, Xhosa, and Sotho. Coloured and white South Africans each account for roughly 300,000. There are 2,750,000 Anglicans in South Africa (World Council of Churches, 2010). To be of assistance to Catholics and Anglicans, the promotion of modern contraceptives to women in the childbearing age requires a dedicated and long-term faith-based programme of education and counseling. While the CTMM is committed to promote reproductive health and family planning services to the general population in and around the City of Pretoria, it does not have a dedicated outreach programme for providing faith-based family planning education and counselling services to Catholics and Anglicans residing in the CTMM.
- Although the study was predominantly quantitative, a little bit of qualitative research was conducted for assessing the perception of women on contraceptive use and the ideal number of children they could afford to have. Three hundred and forty two of the 8, 497 respondents (4.03%) in the study were unable to communicate in English, and required translators. With these respondents, in-depth interviews had to be conducted in local languages such as Zulu, Afrikaans, Sotho and Setswana. Responses obtained from the 342 interviewees were later translated back from the various languages into English for the purpose of coding and text analysis. Although all interviewers were provided with adequate training in this regard, the use of different languages, the need for clarification of some of the items in the questionnaire of study, and the need to translate could have introduced minor bias into the study.

- Two hundred and ninety seven of the 8, 497 women in the study (3.49%) had changed their physical addresses during the 6-year period of study, but could be traced. However, 34 of the 8, 497 women (0.40%) could not be traced. This limitation is a typical feature of a follow-up study.
- A few women were too embarrassed to answer questions related to sexually transmitted infectious diseases and the number of sexual partners they have had over the past 12 months. This could have resulted in an underestimation.

## CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

### 5.1. Conclusion

The two principal objectives of this particular study were to identify key predictors of adverse outcomes of pregnancy among women aged between 15 and 49 years living in and around the City of Pretoria, and to assess the degree of utilization of modern family planning methods. The study aims to provide adequate answers to the research questions: What are the key factors that are responsible for adverse outcomes in pregnancy among women aged between 15 and 49 years living in and around the City of Pretoria? What is the degree of utilization of modern contraceptives? What are the key factors that affect utilization of family planning services provided by the CTMM to women aged between 15 and 49 years living in and around the City of Pretoria? Does utilization of contraceptives and modern family planning methods vary by service delivery wards and facilities? Data were collected on several socio-economic, demographic, health-related and family planning variables from a random sample of 8, 497 women between the ages of 15 and 49 living in and around the City of Pretoria using multi-stage cluster sampling over a 6-year period of study. Survey logistic regression analysis was used for identifying factors that significantly influenced utilization of modern family planning methods. The Cox Proportional Hazards Model was used for identifying factors that strongly influenced adverse outcomes of pregnancy. Multilevel analysis was used to test the presence of significant differences among 20 service delivery wards and 11 health facilities with regards to utilization of modern family planning methods by women.

The study has produced the following key findings: The percentage of women who regularly used modern family planning methods such as condoms, pills, injections, intra-uterine devices and sterilization was 41.74%. The average ages of women at first sex and pregnancy were 18.72 and 19.36 years respectively. Adverse outcomes of pregnancy occurred in 12.19% of women. Injections (54.03%) were most commonly used as a means of modern contraception by the 3, 547 women who used modern contraceptives, followed by pills (19.60%), condoms (15.51%), intra-uterine devices (8.20%), sterilization (2.37%), and vaginal foams (0.28%). Based on odds ratios estimated from logistic regression analysis, utilization of modern family planning methods such as contraceptives was significantly influenced by easy access to services (OR=4.59; 95% CI = 2.18 – 7.38), degree of support from sexual partners (OR=4.51; 95% CI = 2.14 – 7.16), and degree of satisfaction with the quality of services provided at service centers (OR=4.45; 95% CI = 2.12 – 7.03). Based on hazard ratios estimated from the Cox Proportional Hazards Model, the occurrence of adverse outcomes of pregnancy was significantly influenced by easy access to family planning services (HR=4.02; 95% CI = 2.13 – 6.59), unwanted pregnancy (HR=3.79; 95%



CI = 1.24 – 5.69), and young age at first pregnancy (HR=2.89; 95% CI = 1.19 – 4.22). Adjustment was done for religion, level of income, level of education and employment status. Based on results obtained from multilevel analysis, differences among the 20 service delivery wards accounted for 12.49% of the total variation in the quality of services delivered by the CTMM. The difference among the 11 health service facilities accounts for 13.52% of total variation. Facilities and wards jointly account for 26.01% of the total variation. Facilities nested within the same wards are quite different from each other. Women receiving family planning services within the same health facilities are quite similar with each other. This finding clearly shows that services at the level of facilities were not standardized adequately. That is, some facilities were doing much better than others although all facilities are supposed to be equally efficient in terms of service delivery. For example, health facilities rendering family planning services in predominantly white suburbs were significantly better equipped and well resourced in comparison with facilities rendering services in predominantly black suburbs such as Mamelodi.

The study has shown that there were significant differences among service delivery centers and health districts with regards to the quality of services provided as well as adverse outcomes of pregnancy and utilization of modern family planning services provided by the CTMM. The study showed that unwanted pregnancy and adverse pregnancy outcomes among poor black women constitute a major health problem in and around the City of Pretoria, South Africa. There is a dire need for the promotion of community based family planning services specifically aimed at poor women with ages 15 to 49 years. While it is true that community based clinics are the most efficient health service centers for promoting the use of modern contraceptives and family planning methods, the facilities are underutilized and underequipped in comparison with private hospitals and clinics who provide the services to women who can afford to pay for quality services.

In general, the use of modern family planning methods and contraceptives is positively associated with the age of the woman, her level of education and employment status. The research has shown that almost a quarter of black, low-income earning and uneducated women who took part in the study do not have the financial means to purchase modern contraceptives from private pharmacies. Although the CTMM can intensify its awareness campaigns about the benefits of the family planning services it provides to the general population, it ought to make modern contraceptives to needy women who cannot afford to purchase them at private pharmacies.

## 5.2. Recommendations

The study has shed light on the merits and values of services provided by the CTMM. It has also shown that there is room for improvement in the quality of services provided to the general population by the CTMM. Based on the findings of the study, the following recommendations are made to the City of Tshwane Metropolitan Municipality (CTMM) so that where possible, remedial actions could be taken with a view to improve the quality of family planning and reproductive health services provided to women in the childbearing age of 15 to 49 years residing in the four health sub-districts of the CTMM:

- Efforts must be made to reduce adverse pregnancy outcomes and teenage pregnancy in District 4 (mostly black and unemployed women).
- Health education on optimal family size plus incentives should be given to parents in District 4.
- Improved modern family planning and reproductive health services must be provided to women living in health sub-district 4.
- Health education on safe sex practice, abstinence as well as the use of modern family planning methods should be provided to all youth aged 15 to 19 living in and around the City of Pretoria. There should be a fully fledged and well resourced counselling service targeting the youth.
- The quality of family planning services provided at the 20 service delivery wards and 11 health facilities must be standardized.
- According to the World Bank (2010), empirical evidence is essential for the optimal allocation of scarce resources that are required for efficient service delivery. A community based approach should be followed to implement a monitoring and evaluation programme with a view to monitor and assess efficiency in service delivery. Such a monitoring and evaluation programme would enable the collection of statistical data and empirical evidence on key indicators that are integral to all family planning and reproductive health services that are being delivered by the CTMM to women in the childbearing age of 15 to 49 years. Such data sets could be systematically stored and analyzed for the purpose of producing vital reports for decision making and planning by the CTMM. The data sets would also promote research efforts by the CTMM significantly, and enable the CTMM to collaborate with academic and research institutions on research related matters and advocacy.
- It is highly recommended that a similar study be conducted once in five years with a view to produce reliable estimates on key performance monitoring indicators that are relevant to the provision of family

planning services by the CTMM to the general population living in and around Pretoria. This is crucially important for all impact evaluation studies that are planned by researchers working for the CTMM.

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## **LIST OF APPENDICES**

### **APPENDIX 1: PERMISSION FOR USING DATA SET**



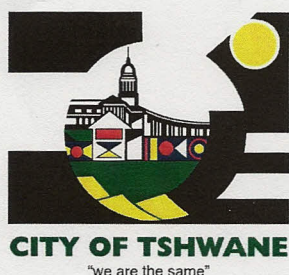
**APPENDIX 2: LETTER FROM LEAP SPECIALIST STRATEGIC & PLANNING SOLUTIONS**

**APPENDIX 3: LETTER OF RESEARCH ETHICS APPROVAL**





**APPENDIX 4: QUESTIONNAIRE OF STUDY**



## Corporate and Shared Services Department

### Tshwane Leadership and Management Academy

Room A208 | Tshwane Academy | 11 Staatsartillerie Road | Pretoria West | 0183  
PO Box 440 | Pretoria | 0001  
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My ref:  
Your ref:  
Contact person: J. Ndou  
Division/Section/Unit: Talent and Learning Management

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My ref/My verw: 16/1/2/1/2

Date/Datum: 06 January 2011

Research Committee  
Tshwane University of Technology School of Business  
PRETORIA  
0001

TO WHOM IT MAY CONCERN

#### REQUEST TO UTILISE CITY OF TSHWANE METROPOLITAN MUNICIPALITY'S (CTMM) DATA SET

Your request to utilize data sets gathered in the CTMM dated 23 December 2010 refers.

After a discussion with the Health Departmental Head, permission has been provisionally granted based on the following conditions:

That the research work conducted by Mr. Solomon Khale and Professor Zeleke Worku will be of significant importance and value to the CTMM in view of the fact that the research has the potential for identifying areas that need intervention and better allocation of resources,

That the data set will be solely used for producing research articles for publication in accredited journals and acquiring academic qualification,

That the draft articles must be scrutinized and signed off by CTMM before publication,

That CTMM will be acknowledged as the owner of the data sets, and

That the CTMM will be furnished with two (2) hard copies of research publications produced by Mr. Khale and Professor Worku.



Should you have any query in this regard please feel free to contact our office.

Yours faithfully,

Kind regards



DR T.J.D. VAN STADEN  
ACTING CEO, TSHWANE LEADERSHIP AND MANAGEMENT ACADEMY

**CULTIVATING INTELLECTUAL CAPITAL**

On request, this document can be provided in another official language.



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09 May 2011

The Research Ethics Committee  
Tshwane University of Technology  
Pretoria 0001

Dear Sir/Madam,

**Re: Research ethics clearance for a study (Factors that affect adverse outcomes of pregnancy among women with ages 15 to 49 in Pretoria, South Africa) conducted by LEAP cc Specialist Strategic and Planning Solutions**

This is to confirm that we have conducted a survey on behalf of the City of Tshwane Metropolitan Council (CTMM) in Pretoria, South Africa in order to identify factors that are responsible for adverse pregnancy outcomes and underutilization of modern contraceptives and family planning services provided by the CTMM. Data was gathered from a random sample of 8, 497 women aged between 15 and 49 years on socio-economic, demographic, health-related and family planning variables between 2004 and 2009. The principal investigator of the research was Dr. Delphin Tshibangu, who was then working in the Health Services Department of the CTMM. Statistical advice and technical training was provided by Professor Zeleke Worku, who was then working at the School of Health Systems and Public Health of the University of Pretoria.

Permission for data collection was obtained from the City of Tshwane Metropolitan Council (CTMM) in Pretoria at the beginning of the study. Enumerators and data collectors were trained on technical and ethical issues that were related to data collection according to the Helsinki Declaration on research ethics. All participants took part in the study did so voluntarily. A full explanation on the purpose and benefits of the study was provided to each participant of the study. Informed consent was obtained from each of the participants in the study at the beginning of the study. All participants were informed of their right to drop out of the study at any time without having to explain why. It was also agreed by all stakeholders of the research exercise that information gathered from the participants of the study would be kept confidential, and that all results of study, reports and publications would be made anonymous.

Should you have any further queries, please feel free to contact us.

Yours faithfully,

Brigid Boltman  
For Leap cc



## Research Ethics Committee

*The TUT Research Ethics Committee is a registered Institutional Review Board (IRB 00005968) with the US Office for Human Research Protections (IORG# 0004997) (Expires 19 Jan 2014). Also, it has Federal Wide Assurance for the Protection of Human Subjects for International Institutions (FWA 00011501) (Expires 31 Jan 2014)*

May 24, 2011

Ref#: 2011/05/008 Name: Khale S Student #: 201138949
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Mr S Khale  
C/o Prof Z Worku  
Business School  
Faculty of Management Sciences

Dear Mr Khale,

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TITLE: Factors that affect adverse outcomes of pregnancy among women with ages 15 to 49 in Pretoria, South Africa

INVESTIGATOR: Khale S

PROGRAMME: Non-degree project

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Thank you for submitting the requested documents and responding to the Committee's suggestions and recommendations.

The Research Ethics Committee of Tshwane University of Technology reviewed the requested documents and your responses to the comments/recommendations. The proposal is **approved**.

Note:

*The reference number [top right corner of this communiqué] should be clearly indicated on all forms of communication [e.g. Webmail, E-mail messages, letters] with the intended research participants.*

Yours sincerely,



AJ Munro (Prof)

Deputy Chairperson: Research Ethics Committee

[Ref#2011=05=008=KhaleS]

Chair: FRIC (Management Sciences) – Dr E Nesamvuni



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# Tshwane University of Technology

## School of Business

### Questionnaire for data collection

<b>Title of Dphil research</b>	<b>Factors that affect adverse outcomes of pregnancy among women with ages 15 to 49 in Pretoria, South Africa</b>
<b>Name, designation and contact details of principal investigator</b>	<b>Zelege Worku, Ph.D.</b> <b>Associate Professor of Statistics</b> <b>Tshwane University of Technology School of Business</b> <b>159 Skinner Street, Pretoria 0001, South Africa</b>  <b>Tel: (+27-12) 382 3050</b> <b>Fax: (+27-12) 382 3052</b> <b>Cell: (+27-82) 870 2758</b> <b>E-Mail: workuz@tut.ac.za</b> <b>Website: www.tut.ac.za</b>
<b>Period of study</b>	<b>01 January 2004 to 31 December 2009</b>
<b>Design of study</b>	<b>Longitudinal</b>
<b>Approval for use of data granted by</b>	<b>Dr. T. J. Van Staden</b> <b>Acting CEO, Tshwane Leadership and Management Academy</b> <b>City of Tshwane Metropolitan Municipality (CTMM)</b> <b>Pretoria 0001, South Africa</b>
<b>Research ethics approval obtained from</b>	<b>Research Committee of Tshwane University of Technology</b> <b>Pretoria 0001, South Africa</b> <b>(Reference Number: 2011/05/008; Date: 24 May 2011)</b>
<b>First promoter of study</b>	<b>Professor Dr. Mammo Muchie, Aalborg University, Denmark</b>
<b>Second promoter of study</b>	<b>Professor Dr. Henrik Halkier, Aalborg University, Denmark</b>



<b>QUESTIONNAIRE:</b> <b>FACTORS THAT AFFECT ADVERSE OUTCOMES OF PREGNANCY AMONG WOMEN WITH AGES 15 TO 49 IN PRETORIA</b>										For office use only	
Questionnaire Number:										Record No.	
Date:	D	D	M	M	Y	Y	Y	Y			
<b>PART 1: INDIVIDUAL LEVEL QUESTIONS</b>											
Name of respondent											A1
Name of health facility											A2
Municipal sub-district number (Please tick appropriate choice)				1							
				2							
				3							
				4							A3
Current age of respondent in years											A4
Age category of respondent: (Please tick appropriate choice)				15 to 24 years			1				
				25 to 34 years			2				
				35 to 49 years			3		A5		
Age of respondent at first sex											A6
Age of respondent at first pregnancy											A7
Highest level of education: (Please tick appropriate choice)				No education or less than a year of formal education			1				
				Primary education			2				
				Secondary education			3				
				Post-secondary education			4		A8		
Average monthly income in Rand: (Please tick appropriate choice)				Less than 1, 200			1				
				Between 1, 201 and 6, 000			2				

	Between 6, 001 and 12, 000	3		
	Between 12, 001 and 20, 000	4		
	Greater than 20, 000	5		A9
Marital status: (Please tick appropriate choice)	Never married	1		
	Married	2		
	Living together	3		
	Divorced	4		
	Separated	5		
	Widowed	6		A10
Religion of respondent: (Please tick appropriate choice)	Christian	1		
	Non-religious	2		
	Muslim	3		
	Hindu	4		
	Jewish	5		
	African traditional religion	6		
	Buddhism or Chinese	7		
	Not known	8		A11
Was your latest pregnancy desired by yourself as the mother? (Please tick appropriate choice)	Yes	1		
	No	2		A12
Family size of respondent: (Please tick appropriate choice)	5 or less	1		
	Greater than 5	2		A13
Have you been employed over the past 12 months? (Please tick appropriate choice)	Yes	1		
	No	2		A14
Do you have easy access to services provided by the CTMM at service delivery centres? (Please tick appropriate choice)	Yes	1		
	No	2		A15

Are you aware of the family planning services provided by the CTMM at service delivery centres? (Please tick appropriate choice)	Yes	1		
	No	2		A16
Is there a nearby family planning service delivery centre (within 3 km of your home)? (Please tick appropriate choice)	Yes	1		
	No	2		A17
Do you have tap water at home? (Please tick appropriate choice)	Yes	1		
	No	2		A18
How much support are you given by your sexual partner in utilizing family planning services provided by the CTMM? (Please tick appropriate choice)	No support at all	1		
	Inadequate support	2		
	Moderate support	3		
	Good support	4		
	Full support	5		A19
Do you discuss family planning issues with your sexual partner as often as the need arises?	Yes	1		
	No	2		A20
Have you ever had a sexually transmitted infectious disease? (Please tick appropriate choice)	Yes	1		
	No	2		A21
Have you ever attended a joint counselling session with your sexual partner on family planning matters? (Please tick appropriate choice)	Yes	1		
	No	2		A22
How much do you trust your sexual partner in terms of being faithful to you on sexual matters?	No trust at all	1		
	Inadequate trust	2		
	Moderate trust	3		

(Please tick appropriate choice)	Good trust	4		
	Absolute trust	5		A23
Do you own a flush toilet at home?	Yes	1		
(Please tick appropriate choice)	No	2		A24
Have you ever given birth to a live child?	Yes	1		
(Please tick appropriate choice)	No	2		A25
Have you ever been pregnant?	Yes	1		
(Please tick appropriate choice)	No	2		A26
How many live children do you have?				A27
How many deliveries have you had so far regardless of the outcome of your pregnancy?				A28
Do you have a sexual partner now?	Yes	1		
(Please tick appropriate choice)	No	2		A29
Does your sexual partner live with you now?	Yes	1		
(Please tick appropriate choice)	No	2		A30
How many sexual partners have you had over the past 12 months?				A31
How many of your own children live with you now?				A32

PART 2: SERVICE DELIVERY QUESTIONS				For office use only
What is the primary source of your contraceptive supply?	1	Public enterprises such as public hospitals, clinics or schools		
	2	Private enterprises such as private hospitals, clinics or schools		
	3	Private pharmacies		B1
What is the primary source of your information on contraceptives and modern family planning methods?	1	Mother		
	2	Father		
	3	Sister		
	4	Close family relative such as aunt, uncle, cousin or grandparent		
	5	Friend		
	6	Teacher		
	7	Nurse		
	8	Medical doctor or physician		
	9	Leaflet or magazine		
	10	Radio or television		B2
What is your health sub-district?	1	Sub-district 1		
	2	Sub-district 2		
	3	Sub-district 3		
	4	Sub-district 4		B3
What is your service delivery ward within CTMM?	1	Ward 1		
	2	Ward 2		
	3	Ward 3		
	4	Ward 4		
	5	Ward 5		
	6	Ward 6		
	7	Ward 7		

	8	Ward 8		
	9	Ward 9		
	10	Ward 10		
	11	Ward 11		
	12	Ward 12		
	13	Ward 13		
	14	Ward 14		
	15	Ward 15		
	16	Ward 16		
	17	Ward 17		
	18	Ward 18		
	19	Ward 19		
	20	Ward 20		<b>B4</b>
What is your health facility within CTMM?	1	Health facility 1		
	2	Health facility 2		
	3	Health facility 3		
	4	Health facility 4		
	5	Health facility 5		
	6	Health facility 6		
	7	Health facility 7		
	8	Health facility 8		
	9	Health facility 9		
	10	Health facility 10		
	11	Health facility 11		<b>B5</b>
What is your degree of satisfaction with the quality of family planning services provided to you by the CTMM?	1	No satisfaction at all		

	2	Inadequate satisfaction		
	3	Moderate satisfaction		
	4	Good satisfaction		
	5	Total satisfaction		<b>B6</b>
Do you currently use at least one modern contraceptive?	1	Yes		
	2	No		<b>B7</b>
Do you use family planning services provided by the CTMM regularly?	1	Yes		
	2	No		<b>B8</b>
What type of contraceptive do you utilize now?	1	Injections		
	2	Pills		
	3	Condoms		
	4	Intra-Uterine Devices (IUDs)		
	5	Sterilization		
	6	Vaginal foam		<b>B9</b>
Have you ever had an adverse outcome of pregnancy such as miscarriage or abortion?	1	Yes		
	2	No		<b>B10</b>

Thank you very much for your participation in the study.

## **ABSTRACT**

### **Factors that affect adverse outcomes of pregnancy among women with ages 15 to 49 in**

#### **Pretoria, South Africa**

**Background:** Poor and uneducated women living in and around the City of Pretoria are characterized by adverse outcomes of pregnancy, high teenage pregnancy, and poor utilization of contraceptives and modern family planning methods. A 6-year long survey (2004 to 2009) was conducted annually by the City of Tshwane Metropolitan Council (CTMM) in Pretoria, South Africa in order to identify factors responsible for adverse pregnancy outcomes and underutilization of modern contraceptives and family planning services provided by the CTMM. Data were gathered from a random sample of 8, 497 women aged between 15 and 49 years on socio-economic, demographic, health-related and family planning variables. Observed values of variables were recorded at the end of the study period (31 December 2009). For survival analysis, data gathered between 01 January 2004 and 31 December 2009 were used.

**Objectives:** The objectives of study were to identify key predictors of adverse outcomes of pregnancy among women aged between 15 and 49 years living in and around the City of Pretoria, and to assess the degree of utilization of modern family planning methods.

**Research questions:** What are the key factors that are responsible for adverse outcomes in pregnancy among women aged between 15 and 49 years living in and around the City of Pretoria? What is the degree of utilization of modern contraceptives? What are the key factors that affect utilization of family planning services provided by the CTMM to women aged between 15 and 49 years living in and around the City of Pretoria? Does utilization of contraceptives and modern family planning methods vary by service delivery wards and facilities?

**Methods:** Data were collected on several socio-economic, demographic, health-related and family planning variables from a random sample of 8, 497 women between the ages of 15 and 49 living in and around the City of Pretoria using multi-stage cluster sampling over a 6-year period of study. Survey logistic regression analysis was used for identifying factors that significantly influenced utilization of modern family planning methods. The Cox Proportional Hazards Model was used for identifying factors that strongly influenced



adverse outcomes of pregnancy. Multilevel analysis was used to test the presence of significant differences among 20 service delivery wards and 11 health facilities with regards to utilization of modern family planning methods by women. Statistical data analysis was performed in the statistical package STATA version 11 (STATA Corporation, 2010).

**Results:** The percentage of women who regularly used modern family planning methods such as condoms, pills, injections, intra-uterine devices and sterilization was 41.74%. The average ages of women at first sex and pregnancy were 18.72 and 19.36 years respectively. Adverse outcomes of pregnancy occurred in 12.19% of women. Injections (54.03%) were most commonly used as a means of modern contraception by the 3, 547 women who used modern contraceptives, followed by pills (19.60%), condoms (15.51%), intra-uterine devices (8.20%), sterilization (2.37%), and vaginal foams (0.28%). Based on odds ratios (OR) estimated from logistic regression analysis with the random effects model, utilization of modern family planning methods such as contraceptives was significantly influenced by easy access to services (OR=4.59; 95% CI = 2.18 – 7.38), degree of support from sexual partners (OR=4.51; 95% CI = 2.14 – 7.16), and degree of satisfaction with the quality of services provided at service centers (OR=4.45; 95% CI = 2.12 – 7.03). Based on hazard ratios (HR) estimated from the Cox Proportional Hazards Model, the occurrence of adverse outcomes of pregnancy was significantly influenced by easy access to family planning services (HR=4.02; 95% CI = 2.13 – 6.59), unwanted pregnancy (HR=3.79; 95% CI = 1.24 – 5.69), and young age at first pregnancy (HR=2.89; 95% CI = 1.19 – 4.22). Adjustment was done for religion, level of income, level of education and employment status. Based on results obtained from multilevel analysis, differences among the 20 service delivery wards accounted for 12.49% of the total variation in the quality of services delivered by the CTMM. The difference among the 11 health service facilities accounts for 13.52% of total variation. Facilities and wards jointly account for 26.01% of the total variation. Facilities nested within the same wards are quite different from each other. Women receiving family planning services within the same health facilities are quite similar with each other (Intra Class Coefficient = 89.37%). This finding clearly shows that services at the level of facilities were not standardized adequately. That is, some facilities were doing much better than others although all facilities are supposed to be equally efficient in terms of service delivery. For example, health facilities rendering family planning services in predominantly white suburbs were significantly better equipped and well resourced in comparison with facilities rendering services in predominantly black suburbs such as Mamelodi.

**Conclusions:** There were significant differences among service delivery centers and health districts with regards to adverse outcomes of pregnancy and utilization of modern family planning services provided by the CTMM. The study showed that unwanted pregnancy and adverse pregnancy outcomes among poor black women constitute a major health problem in and around the City of Pretoria, South Africa. There is a dire need for the promotion of community based family planning services specifically aimed at poor women with ages 15 to 49 years. While it is true that community based clinics are the most efficient health service centers for promoting the use of modern contraceptives and family planning methods, the facilities are underutilized in comparison with hospitals and private sector service providers.

**Key words:** Family planning methods, adverse outcomes, hazard ratio, multilevel analysis.

## **ABSTRACT**

### **Faktorer, der påvirker bivirkninger ved graviditet blandt 15-49-årige kvinder i Pretoria, Sydafrika**

**Baggrund:** Blandt fattige kvinder uden uddannelse, der bor i og omkring City of Pretoria, er der høje forekomster af bivirkninger ved graviditet, teenage-graviditet, og begrænset brug af prævention og moderne familieplanlægning. City of Tshwane Metropolitan Council (CTMM) i Pretoria, Sydafrika foretog en årlig undersøgelse fra 2004 til 2009 for at identificere de faktorer, der ligger til grund for de bivirkninger ved graviditet og underforbrug af moderne prævention og familieplanlægningsservices, som CTMM udbyder. Data blev indhentet blandt 8.497 tilfældigt udvalgte kvinder mellem 15 og 49 år baseret på socioøkonomiske, demografiske, sundhedsrelaterede og familieplanlægningsvariable. De observerede værdier af variablene blev registreret ved slutningen af undersøgelsen (31. december 2009). Overlevelsesanalysen er baseret på data indhentet mellem 1. januar 2004 og 31. december 2009.

**Formål:** Undersøgelsens formål var at identificere nøgleindikatorerne for bivirkninger ved graviditet blandt 15-49-årige kvinder, der bor i og omkring City of Pretoria, og at bedømme i hvilket omfang kvinderne benytter sig af moderne familieplanlægningsmetoder.

**Forskningsspørgsmål:** Hvad er nøglefaktorerne for bivirkninger ved graviditet blandt 15-49-årige kvinder, der bor i og omkring City of Pretoria? I hvilket omfang benytter kvinderne moderne prævention? Hvilke nøglefaktorer påvirker brugen af de familieplanlægningservices, som CTMM tilbyder kvinder mellem 15 og 49 år, der bor i og omkring City of Pretoria? Varierer brugen af prævention og moderne familieplanlægning blandt de distrikter og klinikker, der udbyder denne service?

**Metoder:** Data blev indsamlet på forskellige socioøkonomiske, demografiske, sundheds- og familieplanlægningsvariable blandt 8.497 tilfældigt udvalgte 15-49-årige kvinder, der bor i og omkring City of Pretoria ved hjælp af flertrins klynge sampling over en seksårig

undersøgelsesperiode. Logistisk regression blev anvendt til at identificere faktorer, der i høj grad påvirkede brugen af moderne familieplanlægningsmetoder. Cox's Proportional Hazards Model blev anvendt til at identificere faktorer, der havde en signifikant indflydelse på negative effekter af graviditet. Flertalsanalyser blev anvendt til at teste om kvindernes brug af moderne familieplanlægning varierede betydeligt blandt de 20 serviceudbydende distrikter og 11 sundhedsklinikker. Statistisk dataanalyse blev udført ved hjælp af STAT version 11 (STATA Corporation, 2010).

**Resultater:** 41,7 procent af kvinderne brugte regelmæssigt moderne familieplanlægningsmetoder såsom kondomer, piller, indsprøjtninger, spiraler og sterilisering. Gennemsnitsalderen for seksuel debut og første graviditet var hhv. 18,72 og 19,36. Bivirkninger ved graviditet forekom hos 12,19 procent af kvinderne. Indsprøjtninger (54,03 procent) var den mest udbredte prævention blandt de 3.547 kvinder, der brugte moderne prævention. Dernæst kom piller (19,60 procent), kondomer (15,51 procent), spiral (8,20 procent), sterilisering (2,37 procent), og sæddræbende skum (0,28 procent). Baseret på odds ratios (OR) beregnet ved logistisk regression ved stokastisk effekt-model, er brug af moderne familieplanlægningsmetoder såsom prævention stærkt påvirket af let adgang til services (OR=4,59; 95% CI = 2,18 – 7,38), graden af støtte fra sexpartnere (OR=4,51; 95% CI = 2,14 – 7,16), og tilfredshed med kvaliteten af de services, der blev tilbudt på centrene (OR=4,45; 95% CI = 2,12 – 7,03). Ifølge hazard ratio (HR) beregnet ved hjælp af Cox Proportional Hazards Model, havde nem adgang til familieplanlægning services stor indflydelse på forekomsten af bivirkninger ved graviditet (HR=4,02; 95% CI = 2,13 – 6,59), uønsket graviditet (HR=3,79; 95% CI = 1,24 – 5,69), og teenage-graviditet (HR=2,89; 95% CI = 1,19 – 4,22). Justeringer blev foretaget for religion, indkomst, uddannelse og beskæftigelsesstatus. Ifølge resultaterne af multilevel analysen, skyldes 12,49 procent af den samlede variation i kvaliteten af services leveret af CTMM forskelle mellem de 20 serviceudbydende distrikter. 13,52 procent af den samlede variation skyldes forskellen mellem de 11 sundhedsklinikker. Klinikker og distrikter forklarer sammenlagt 26,01 procent af den samlede variation. Klinikker, der ligger inden for samme distrikt, er meget forskellige. Kvinder, der modtager familieplanlægningsservices i de samme

sundhedsklinikker er meget ens (intraklassekoefficient = 89,37%). Dette resultat viser klart, at services på klinikniveau ikke er tilstrækkeligt standardiserede, dvs. nogle klinikker klarede sig meget bedre end andre, selvom klinikkerne burde være lige effektive. For eksempel havde familieplanlægningsklinikker i overvejende hvide forstæder meget bedre udstyr og flere ressourcer end klinikker i overvejende sorte forstæder, fx Mamelodi.

**Konklusion:** Der var betydelige forskelle i servicecentre og sundhedsdistrikter mht. bivirkninger ved graviditet og brug af moderne familieplanlægningsservices udbudt af CTMM. Undersøgelsen viste, at uønsket graviditet og bivirkninger ved graviditet blandt fattige sorte kvinder udgør et betydeligt sundhedsproblem i og omkring City of Pretoria, Sydafrika. Der er hårdt brug for at promovere lokalt baserede familieplanlægningsservices, specielt rettet mod fattige kvinder mellem 15 og 49 år. Mens det er sandt, at lokale klinikker er mest effektive i forhold til at fremme brug af moderne prævention og familieplanlægningsmetoder, så bliver klinikkerne ikke brugt nok sammenlignet med hospitaler og private serviceudbydere.

**Nøgleord:** Familieplanlægningsmetoder, negative effekter, hazard ratio, multilevel analyse

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